CALDERWOOD'S
ORTHOPEDIC NURSING

Calderwood's Orthopedic Nursing

Revised by

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With 307 Illustrations

FOURTH EDITION

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THIS BOOK IS DEDICATED

TO

ARTHUR STEINDLER, M D

Professor Emeritus of Orthopedic Surgery at the University of Iowa and Early Teacher of the Authors

FOURTH EDITION

Second Printing

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United States of America

PREFACE TO FOURTH EDITION

This fourth edition of *Calderwood's Orthopedic Nursing* constitutes a revision with a twofold purpose. Primarily, new procedures and methods of treatment that have evolved as a natural sequence of progress have been added. Secondly, improvements which have resulted from collective criticisms of the last edition have been made in several areas. A thorough evaluation of student and faculty comments directed at deficiencies, omissions, and underemphasis has led to changes which the authors feel will improve the value of the text in both content and reference availability.

It is hoped that the material herein assembled will help the nurse to provide the best possible care for her patient. Furthermore, we hope that this text will make the student's experience in orthopedics a most satisfying one.

The authors wish to take this opportunity to gratefully acknowledge the valuable suggestions and constructive criticisms received from both the teachers and students who have used the book.

C. L.
M. G.

FOREWORD

By Jessie Stevenson West
Formerly Associate Professor of Nursing (Orthopedic),
Vanderbilt University, and Consultant in Orthopedic Nursing,
National Organization for Public Health Nursing

"It is the mind which is truly alive and sees things but it will hardly see anything without instruction" —Charcot

This statement from the great French neurologist is quoted in the introductory chapter of this textbook, with the comment, "This wise observation might well serve as a professional axiom for all teachers of student nurses"

The preceding editions of this book have helped instructors to meet this challenge and have stimulated students in nursing to develop understanding as well as skill in the care of orthopedic and other patients All concerned in the prevention of crippling and in improved patient care will be profoundly grateful that this valuable teaching aid is to be continued

It is singularly appropriate that the authors of this revision are faculty members of the University of Iowa schools of medicine and nursing, since the original authors were associated with these schools in similar capacities The content, however, is comprehensive and not limited to methods of one institution or locality

The previous editions were widely acclaimed because the focus was on *nursing* Marjorie Gould, a former student and co worker of Carmelita Calderwood, is well qualified, because of her preparation and broad experience as a staff nurse, supervisor, and instructor in orthopedic nursing, to continue and strengthen the emphasis on the role of nursing in the total care of orthopedic patients

This revision retains and amplifies all the strong features of the preceding editions For example, there is an over all rather than a fractional approach in analyzing the needs of the orthopedic patient and his family as a basis for comprehensive nursing and effective participation in the team concerned in rehabilitation

Significant changes in this edition are new and revised content and rearrangement of subject matter in more logical seqeunce Examples

PREFACE TO FIRST EDITION

This textbook on orthopedic nursing is presented in an attempt to bring together in one volume the background of medical information and nursing techniques necessary to assist the nurse in caring for the orthopedic patient It is not intended to be encyclopedic, and the lesser known entities have been passed over briefly or omitted entirely where the judgment of the authors considered it permissible The book is not, of course intended to take the place of a comprehensive reference text on the subject of orthopedic surgery

Principles remain constant, only techniques vary Recognizing this, the authors have sought to place emphasis upon established principles of knowledge and procedure, realizing that such variations as occur in different parts of the country are so manifold that no textbook of this size could take cognizance of all of them With the foundation in principle well laid, it was thought that the student's own natural ability to adapt to various life situations could be counted upon The adjust ability aim of the *Curriculum Guide* clearly supported our thinking in this matter

Gratitude is due to the members of the Joint Orthopedic Nursing Ad visory Service, and in particular to Jessie L Stevenson, without whose invaluable assistance the material herein would have been less compre hensive

Acknowledgment is likewise due to the students, the head nurses, and the faculty of Denver Children s Hospital and the University of Virginia Hospital for suggestions and assistance which they gave in working out many difficult nursing problems

R F
C C

CONTENTS

UNIT I

INTRODUCTION FOR THE TEACHER AND THE STUDENT

UNIT II

GENERAL FEATURES OF ORTHOPEDIC NURSING

of important new content are the chapters on cerebral palsy and metabolic disorders of bone The section on bone metabolism is a concise and illuminating presentation of a complex subject Nursing instructors will welcome the new and revised guides for study and will find the new material which has been incorporated in the chapter on nursing care of the patient in traction especially useful in teaching

Changes in format, such as the addition of many subheadings, make for ease in reading and thus conserve time The large number of new illustrations are in accord with recent developments in treatment and increase the eye appeal The changes in organization and presentation of the subject matter lend clarity and perspective to the text and contribute to its coherence and compactness

This is a book which students as well as instructors in nursing will want to own Unit I, Introduction for the Teacher and Student, contains a wealth of practical detail which is fundamental for any field in nursing Some of this will change in subsequent editions as more is learned about causes and treatment of orthopedic conditions, but the underlying philosophy which permeates every line reflects Carmelita Calderwood's dynamic concept of nursing, which has been caught by her students and associates and will continue to live and grow

UNIT IV

DEVELOPMENTAL DISEASES OF BONE

CHAPTER 10

UNIT V

INFECTIONS OF BONES AND JOINTS

CHAPTER 11

CHAPTER 12

CHAPTER 13

CHAPTER 14

UNIT IX
CEREBRAL PALSY

CHAPTER 20

CHAPTER 21

UNIT X
COMMON PAINFUL AFFECTIONS IN ADULTS

CHAPTER 22

CHAPTER 23

UNIT VI
METABOLIC DISORDERS OF BONE

UNIT VII
ARTHRITIS

UNIT VIII
POLIOMYELITIS

CALDERWOOD'S
ORTHOPEDIC NURSING

Unit I

INTRODUCTION FOR THE TEACHER AND THE STUDENT

Chapter 1

PRINCIPLES OF GOOD NURSING CARE APPLIED TO THE ORTHOPEDIC PATIENT

Orthopedic nursing has often been defined as the application of the principles of good body mechanics to all nursing If this is true, no text book on the subject can rightfully be without a discussion of what the elementary principles of good body mechanics are, and *how* they apply to *all* nursing

In the past, the principles of good body mechanics and body alignment have frequently been referred to as "orthopedic aspects" of nursing care This assumption is questionable, and perhaps it is presumptuous to allocate to one medical specialty the principles which, like cleanliness and adequate nutrition, belong to all branches of healing It is far better to think of these principles as being fundamental to the care of every patient, and as such they are principles of good nursing care However, there is not much doubt that in this clinical specialty more emphasis is placed on this subject than in any other branch of medicine or nursing It seems logical, therefore, to begin a textbook of orthopedic nursing with a discussion of the fundamental principles upon which the prevention, as well as the treatment, of orthopedic conditions is based

The definition given above—that orthopedic nursing is the application of the principles of good body mechanics to all nursing—sometimes presents an unfamiliar concept to nurses working in highly specialized orthopedic services in hospitals But analysis of any equipment or apparatus used in the care of the orthopedic patient will reveal that its fundamental purpose is maintenance or restoration of good body mechanics for the patient Student nurses, looking askance at a sharply angulated turnbuckle cast, have often been puzzled by the abnormal position of the patient in the cast It seems to be the very reverse of good body me

chanics[1] Nevertheless, the overcorrected position which the cast maintains is one step along the road to recovery of a normal spine, and it may be impossible to apply principles of good body mechanics to the patient until a period of overcorrection has been maintained

A decade ago those of us in orthopedic nursing were absorbed almost entirely in the care of patients with affections of the musculoskeletal system Indeed, we who were teaching the subject to student nurses often prefaced our lectures with a definition of orthopedic nursing as the care of patients with disease or dysfunctions of the musculoskeletal system There was at that time little carry over of what we knew about orthopedic nursing to patients in other divisions of the hospital The patient on the medical or surgical ward, for instance, had very little attention paid to his musculoskeletal system All too often a patient recovering from a cerebral accident and hemiplegia was allowed to lie in unphysiological positions which often contributed to a condition of permanent deformity But it must be admitted that the same oversight occurred on orthopedic wards where not infrequently patients with osteomyelitis developed flexion contractures in uninvolved joints such as the hip or knee from long continued positions of flexion, nor was it uncommon to have patients who had lain on Bradford frames over a period of months develop drop feet because no support was provided for the feet on the frame It was surely lamentable to be so absorbed in the care of a patient with an existing deformity that one failed to see the forces at work to bring about other deformities, but in the past we were often guilty of the oversight

Sir Robert Jones spoke very truly when he said 'It can never be realized too widely that deformity is an unnatural and preventable affliction, which treatment may alleviate or cure but which a more complete understanding could abolish" In the past decade the emphasis placed by nursing educators on a more complete understanding of the causes and prevention of crippling has been most heartening Nursing instructors clinical instructors and teachers of the sciences are doing their best to overcome the old specialistic tendencies of orthopedic nurses They have seen to it that the principles of good body mechanics are included in the subject matter they teach in reference both to the patient and to the nurse herself One has only to read the more recent nursing textbooks on clinical subjects to see how well these principles have been integrated into all branches of nursing It seems altogether unlikely that they will ever be forgotten or overlooked again

Nevertheless, the subject will bear "enormous repetition, representation and illustration in all possible forms."* It is, in fact, scarcely possible to overemphasize the need for attention to good alignment and the recognition of limitation of joint motion in all phases of nursing activity.

POSTURE AND BODY MECHANICS

Student nurses who are given the benefit of an initial posture analysis by an orthopedic specialist early in their career are fortunate. They are still more fortunate if their postural weaknesses can be pointed out to them in the presence of someone equipped to help them overcome these weaknesses—an instructor in physical education, if there is one on the faculty, or perhaps the hospital physical therapist. The advice which the orthopedist gives the student at this time can be interpreted to her by the physical education teacher, who will be able to follow up her progress later both in the classroom and on the wards. Corrective exercises, if prescribed, will often bring about noteworthy improvements in the student's posture, *if* she understands their purpose, is adequately supervised in their performance, and is faithful in the practice of them. But it is indispensable that the student know what she is seeking to accomplish and how she is to accomplish it. It would be sufficient for her to do all these things without thought—to learn posture on what might be called a subconscious level—if she were not being prepared to be a health teacher as well as a nurse.

It seems indispensable, too, that every nurse should know how to select a shoe for duty wear so that she may purchase her shoes intelligently, undisturbed by the rhetoric of the shoe salesman. The characteristics of a good shoe and the proper fitting of the shoe should be so well known to her that she will not be confused by imposing trade names, fancy prices, or an engaging array of built in gadgets.

We know that learning is not conceded to be effective before behavior is altered in some way because of it. As William James so aptly put it in his *Talks to Teachers on Psychology*, 'An impression which simply flows in at the pupil's eyes or ears, and in no way modifies his active life, is an impression gone to waste. It is physiologically incomplete.' Probably no nurse completes her nursing course today without being able to recite the points a plumb line should pass through for proper body stance. No doubt most of them will be able to write down for State

* Holmes, Oliver Wendell. *Medical Essays. Scholastic and Bedside Teaching.* Boston, 1892. Houghton Mifflin Company.

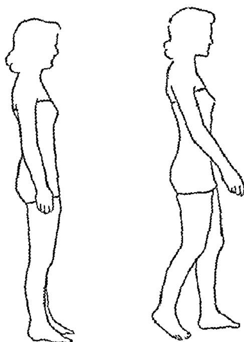


Fig 1 —Good standing and walking posture Note position of the head normal curves of the spine the flat abdomen and relaxed position of the knee joints

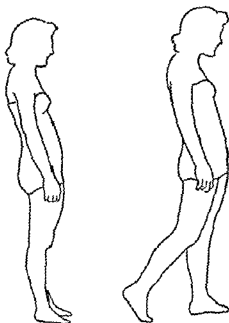


Fig 2 —Poor standing and walking posture Note forward position of the head the round shoulders increased lumbar lordosis flat chest protruding abdomen and hyperextended knees



Fig 3 —Good sitting posture (From Posture and Nursing' by Jessie L Stevenson Courtesy the Joint Orthopedic Nursing Advisory Service)



Fig 4 —Poor sitting posture (Courtesy the Joint Orthopedic Nursing Advisory Service)

Board Examination, if it is required of them, some of the criteria of good posture that the sternum should be the most forward portion of the body, that the head is to be held up, and the chin in, that the lower abdomen should be flat and retracted, that the curves of the spine should be maintained without exaggeration, that the knees should be in a relaxed position (not hyperextended), and that the feet should point straight ahead However, she is probably capable of writing down these gems of wisdom with her feet wrapped tightly around the chair rungs, her chin glued to her caved in sternum, and her back round as a barrel hoop

Whether she can interpret good posture to herself in a kinesthetic sense is conjectural She may secretly still be convinced that a slouchy posture is easier and more comfortable for her and that good posture is a position leading to fatigue and strain Having only theoretic knowledge—with which her own experience is perhaps not in accord—it is questionable if she will be able to describe good posture in simple language for the benefit of the patient who is rising from his bed after long recumbency Even if she can do this, there is still the question as to whether she will be able confidently to accompany her verbal description with a graphic example of what she means by reference to her own body alignment, and unless she *can* do this, her knowledge remains academic If she herself does not understand the necessity for good posture and does not apply it to her everyday living, she will hardly be able to transmit her knowledge to others in a vital effective manner and she will not be able to present a very convincing object lesson in her own activities

The cosmetic appeal for good posture probably does as much as any one other motivating factor to stimulate the student's interest Most young women can be approached through this channel Because she is young and resilient, she seldom feels the result of the day s mechanical misuse of her body—certainly not seriously enough to keep her from dancing half the night in four inch heels and it is difficult if not impossible to project her imagination forward to the day when she will be thirty when the aches of approaching middle age will be upon her Most students, however, are tremendously interested in their waistlines Their hips are a constant source of speculative consideration as they rip the Cellophane off a candy bar Any exercises given to the student for the reduction of this particular anatomical overload usually bring about some definite display of interest and earnestness She firmly intends to carry out her exercises faithfully morning and evening If she has the hardihood to do it, so much the better for her, but persistence in this

is in the lap of the gods Meanwhile, she begins to have a concept of posture built upon a realization of how much cosmetic benefit occurs from her occasional tensing of the abdominal muscles accompanied by a contraction of the gluteals She has only to look in the mirror to observe the effects of that, and this may be the beginning of an attempt to create a more efficient set of corset muscles which will be helpful to her in many activities having to do with the care of patients, although it must be admitted that this will probably not be her first consideration in acquiring them Nevertheless, the first step is an important one

Over fifty years ago physical educators and doctors interested in problems of the low back were pointing out the importance of the muscles of the trunk in strenuous activity The rectus abdominal muscles, the oblique abdominal muscles, and the gluteals were spoken of as an inner girdle which surrounded and supported the underlying pelvic structures When this group of muscles was in good tone, the likelihood of strain in the normal back became much lessened Adequately developed trunk muscles made possible many feats of physical activity which otherwise could not be undertaken except at the expense of possible inefficiency and strain It is now well recognized that a soft, flabby middle section of the body is a liability to anyone engaged in active physical work A nurse should learn early how to use the internal girdle which is her own, whether she elects to wear an external one or not

Practice of nursing procedures can easily include concurrent practice in correct body mechanics Once the student has learned to carry out her procedures using correct body mechanics, it becomes a conditioned skill which she will be likely to carry with her into similar situations on the ward The carry over to the patient will not be automatic The situation facing the beginning student is very complex and there are many things for her to remember in the early days on the ward She will need guided instruction None of this material can be given in one gigantic dose, it must be given in suitable small doses and repeated often That is why it is so important that all the teaching personnel—supervisors, head nurses, and staff nurses—who will come in contact with the student should be well grounded in the subject and convinced, as well, of its importance

It is not the purpose of this book to consider the subject of body mechanics in detail The writer is not prepared to cover such material adequately, nor will space permit a detailed discussion Many excellent books and articles are now available for the student and the teacher who wish to make a study of the subject Only a few simple suggestions for

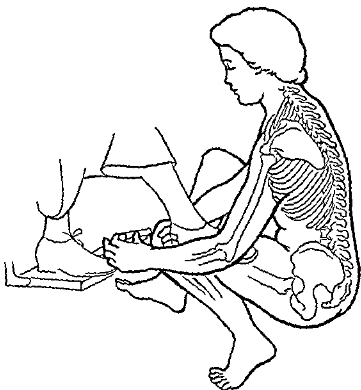


Fig 5—Correct position for working at a lower level Note *flexed position of the hips and knees the foot forward position the shoulders in the same plane as the pelvis* (Courtesy National Advisory Service for Orthopedics and Poliomyelitis, and Alfred Feinberg artist College of Physicians and Surgeons, Columbia University)

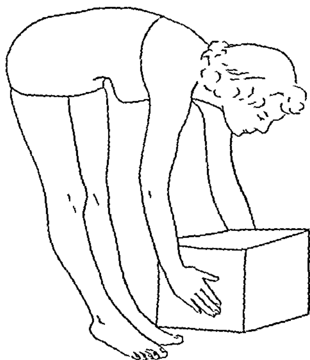


Fig 6—Incorrect position for working at lower levels Note parallel feet and hyperextended knees *Working or lifting in this position places strain on the back muscles*

Fig 7—Position of ease in removing linen from bed (Courtesy Joint Orthopedic Nursing Advisory Service)

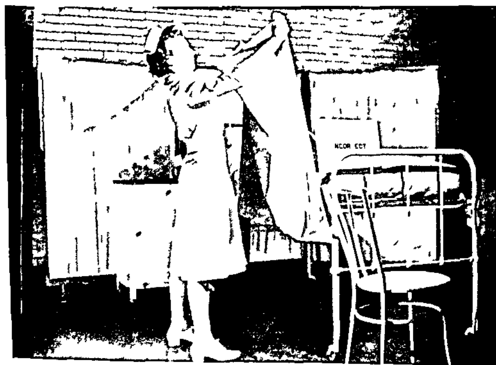


Fig 8—Position of strain in removing linen from bed (Courtesy Joint Orthopedic Nursing Advisory Service)

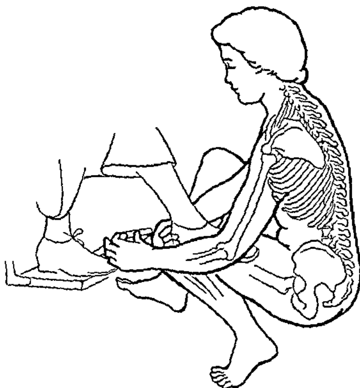


Fig 5 —Correct position for working at a lower level Note flexed position of the hips and knees, the *foot forward* position the shoulders in the same plane as the pelvis (Courtesy National Advisory Service for Orthopedics and Poliomyelitis and Alfred Feinberg artist College of Physicians and Surgeons Columbia University)

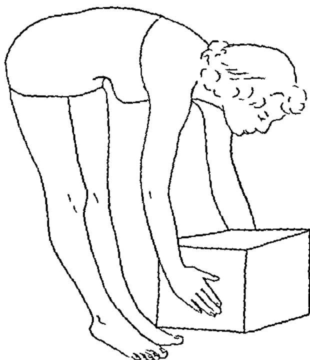


Fig 6 —Incorrect position for working at lower levels Note parallel feet and hyperextended knees Working or lifting in this position places strain on the back muscles

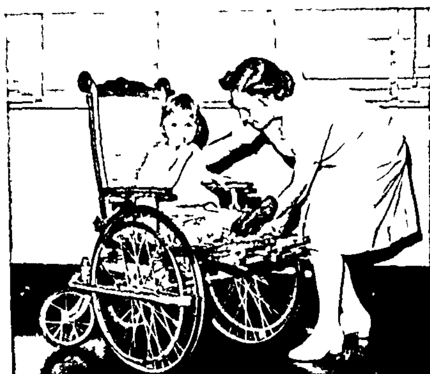


Fig 10.—Correct position for lifting

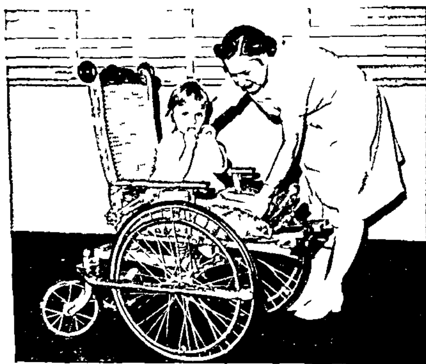


Fig 11.—Incorrect position for lifting Note hyperextended knees

the student's guidance will be included here Analysis and discussion of these suggestions might be included in the student's course in anatomy and physiology, in the section on the erect and moving body

1 In bending to retrieve an article from the floor, to lift, or to bathe a patient in a low bathtub, flex both knees and hips, keep the back straight and the shoulders in the same plane as the pelvis, have the feet apart and assume the foot forward position Do not bend at the hips with the knees straight or with the back rounded, for this will put the

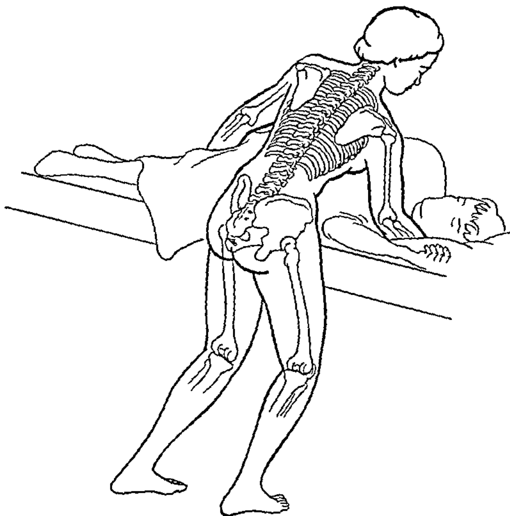


Fig 9—When working at the bedside, assume the foot forward position face your work flex knees and hips slightly and maintain the shoulders in same plane as the pelvis Protect the small muscles of your back while making the big muscles of the thigh work (Courtesy National Advisory Service for Orthopedics and Poliomyelitis and Alfred Feinberg artist College of Physicians and Surgeons Columbia University)

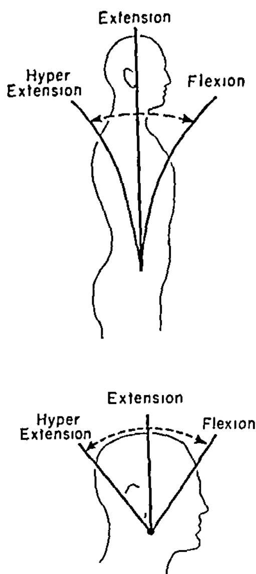


Fig 12—Flexion extension and hyperextension of the spine

strain of any lifting you may do on the back, where the muscles of extension are relatively inefficient, rather than on the stronger, more massive muscles of the thigh and buttock where it rightfully belongs Avoid rotatory movements of the spine in lifting, and never lift an impossible load in an attempt to keep from asking for help Avoid lateral twisting movements when reaching for objects above your head or out at the side

2 Prepare yourself for strenuous activity when it is required of you, by "setting' the pelvis, i e, by retracting the abdominal muscles and contracting the gluteals ('Up in front, down in back," "Pull and pinch,' are sometimes used to give this concept to the student)

3 Carry heavy burdens close to your body

4 When you are moving a patient in the bed, avoid lifting or pushing movements if you can possibly do so Stand on the side toward which you wish to move the patient and exert the pull toward your own body

5 Sit with hips well back in the chair, weight on ischia and thighs, the feet flat on the floor, and the trunk in the same position you would assume in standing

6 When lying in bed, the position of the body should approximate standing posture as nearly as possible in the horizontal If lying on the back, avoid multiple pillows under the head, for they will depress the chest and force the chin forward Pillows should support spine and shoulders as well as head Support to the feet should be provided to prevent foot drop and pressure on the toes from bedclothing If lying face downward, a flat pillow extending from the lower border of the ribs to the pelvis will provide relaxation and comfort for the spinal muscles While lying in this position the feet are supported by a pillow placed under the lower leg or by being allowed to hang over the edge of the mattress

FUNDAMENTAL JOINT MOTIONS

It is desirable for the beginning student nurse to learn to use certain anatomical terms having to do with the position of the body These words have sometimes been erroneously referred to as part of an orthopedic vocabulary but the student first learns them in anatomy and should carry them from that course to the study of nursing They should be familiar to her long before she has seen an orthopedic patient. The following joint motions are almost indispensable for understanding the simplest and most fundamental problems of body mechanics

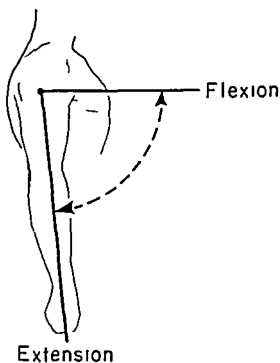
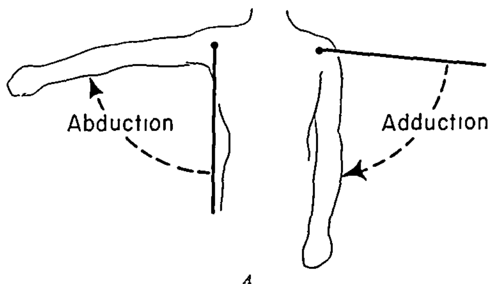


Fig 14 —Flexion and extension of the shoulder joint



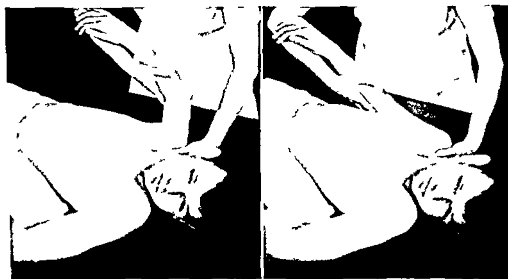


Fig 13—Abduction and adduction of the shoulder joint Note method of supporting paralyzed arm. (Photographs courtesy Iowa State Services for Crippled Children)

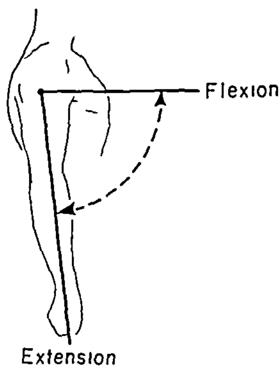
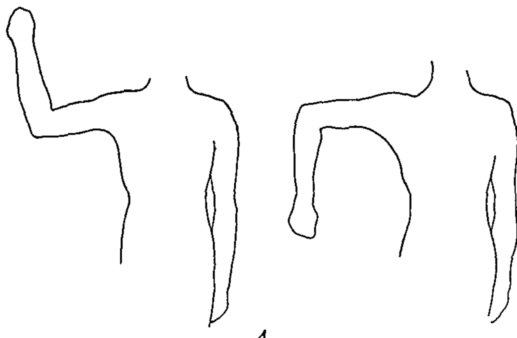


Fig 14.—Flexion and extension of the shoulder joint



A

Abduction with external rotation

Abduction with internal rotation





B

Adduction with external rotation

C

Adduction with internal rotation

Fig 15—External and internal rotation of the shoulder joint (Photographs courtesy Iowa State Services for Crippled Children)

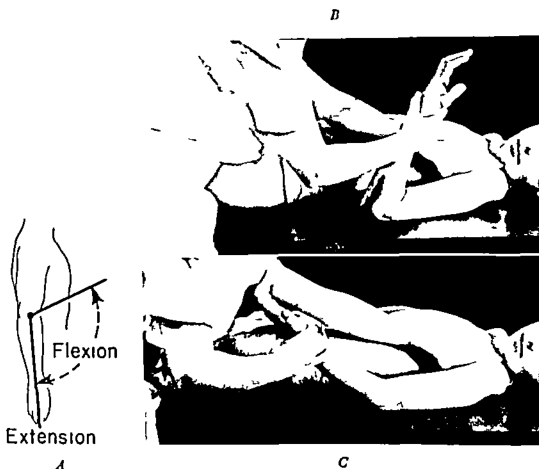
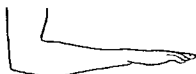


Fig 16 —Flexion and extension of the elbow (Photographs courtesy Iowa State Services for Crippled Children)





A



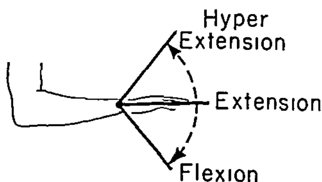


B *C*

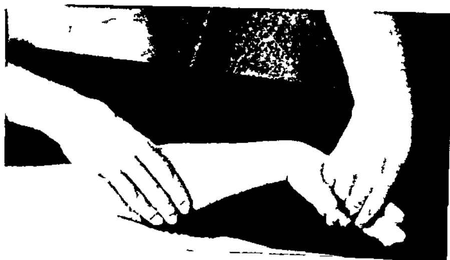
Fig 17 —Pronation and supination of the forearm Note method of grasping the hand (Photographs courtesy Iowa State Services for Crippled Children)



A



B



C

Fig 18—Flexion extension and hyperextension of the wrist (Photographs courtesy Iowa State Services for Crippled Children)



A





B



C

Fig 21 —External and internal rotation of the hip (Photographs courtesy Iowa State Services for Crippled Children)

of the bed patient Many others will be learned, but it is urged that these, at least, become part of the working vocabulary of every nurse giving bedside care

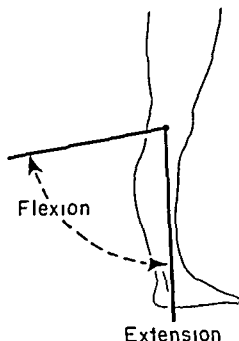


Fig 22 —Flexion and extension of the knee

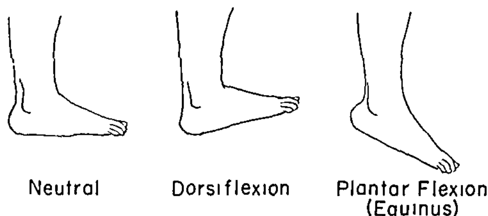


Fig 23 —Dorsiflexion and plantar flexion of the foot

BODY ALIGNMENT FOR THE BED PATIENT

To prevent deformities, the nursing care of the patient confined to bed must include maintenance of good body alignment plus frequent change of position Unaffected joints should be taken through a full range of motion at least once daily The inactive patient, whether con



A





B



C

Fig 21 —External and internal rotation of the hip (Photographs courtesy Iowa State Services for Crippled Children)

poor functional position If this picture is tilted so that the patient assumes the standing position, one immediately recognizes the poor posture and the possible handicapping deformities

Good Fig 25 illustrates a good back lying position The patient is lying on a firm nonsagging mattress, the footboard holds the covers off the toes and maintains the feet in a "walking position," midway between dorsiflexion and plantar flexion The small pillow or bath blanket placed under the calves of the legs lessens the pressure on the heels, a likely spot for decubiti This arrangement, also, provides for a relaxed position of the knee joint and avoids pressure on the popliteal space The trochanter roll is made by folding a sheet or bath blanket in thirds lengthwise, then in half crosswise The smooth folded edge is placed under the buttocks of the patient, and the outer end is rolled under firmly against the thigh This roll assists in maintaining a neutral position of the extremity The leg is held with the kneecap and toes pointing forward, the position desirable for walking when the patient is ready for ambulation A small pillow or folded pad placed under the low back area gives support to the normal lumbar curve This nursing measure will add considerably to the comfort of the patient forced to lie on his back for indefinite periods



Fig 26 —Positions of rest for the arms The right arm illustrates a position of abduction with internal rotation The left arm illustrates a position of abduction with external rotation Note the position of the wrist and fingers

The arms may be abducted and internally rotated, with the forearm supported on a pillow This position may be changed by placing the abducted arms in a position of external rotation, as illustrated in Fig 26 The wrist is maintained in a functional position, slightly dorsiflexed, the fingers flexed If the wrist is to become ankylosed, the fingers and hand

fined to bed or the wheel chair, is prone to develop joint contractures and deformities in a relatively short time Figs 24 to 31 illustrate good and bad body alignment, which is of special importance for the patient with muscle weakness or paralysis

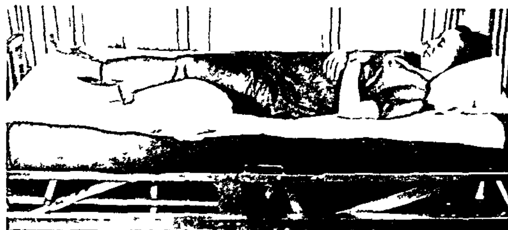


Fig 24 —Poor body alignment in the supine position



Fig 25 —Good body alignment in the supine position

Supine Position —*Bad* Fig 24 illustrates a poor back lying position Note the equinus (drop foot) position of the feet and the external rotation of the lower extremities The left limb is not only externally rotated but the knee and hip joints are held in a flexed position The adducted position of the arms and the forward position of the head with the chin on the sternum decrease the chest capacity The drop wrist position, one commonly assumed by the arthritic patient, places the hand in a

Prone Position —*Bad* When the patient is turned to the face lying position and no support is placed beneath the ankles, the feet are forced to remain in a drop foot position (plantar flexed) (Fig 27) This illustration also shows a markedly increased hyperextension of the lumbar spine It is apparent that the patient would be more comfortable with a support placed beneath the abdomen and with the head pillow removed When in the face lying position, the pillow beneath the head causes hyperextension of the cervical and lumbar spine



Fig 29 —The footboard with blocks provides a space at the foot of the bed making it possible for the patient s feet to extend over the end of the mattress

Good In the prone position the head pillow may be used to support the feet This prevents a drop foot position and also provides for slight flexion of the knee joints The same result may be obtained by having the feet extend over the edge of the mattress with a small roll placed beneath the ankles Some individuals are more comfortable with a thin pillow beneath the abdomen This support protects the breasts and prevents an increased lordosis of the lumbar spine Other patients, however, can be made comfortable without this pillow and still maintain good body alignment The abducted and externally rotated position of the arms (spread eagle position) is restful and permits full expansion of the chest Usually no pillow is needed beneath the head

Side Lying Position —*Bad* Fig 30 illustrates a poor side lying position Note the adducted position of the uppermost leg and the adducted position of the arm with little room for chest expansion

Good When turning the patient to the side lying position, support the uppermost leg with pillows This prevents an adducted position of the extremity as well as pressure on the lower limb When the patient is permitted to lie with the leg in adduction, additional strain is placed on the hip joint and low back region This is especially bad for the pa

are more useful if the wrist is fixed in this cockup position It should be remembered, also, that the hand is most useful when the thumb is in a position to oppose the fingers, that is, a grasping position



Fig 27 —Poor body alignment in the prone position



Fig 28 —Good body alignment in the prone position

If one pillow is used for the head, it should be placed so that the lower edge is well down under the shoulders This helps to keep the chest forward and avoids flexion of the cervical spine If three pillows are used the first pillow must be placed well down under the back so that the head and shoulders are supported in good alignment

maintain the body in a standing position a higher degree of muscle tonus is required than for lying in bed After a day at bed rest, the statement is often made that one feels a weakness out of all proportion to the minor illness one has experienced From this common observation, the student can easily understand that when bed rest is continued over a considerable period of time, muscle tone may be greatly depleted Lack of muscle tone in even healthy subjects produces wasting of the muscles, often referred to as disuse atrophy Muscles with diminished tone may become permanently stretched from being held in a lengthened position, or they can become contracted by being held in a shortened position, thus producing so called myostatic contractures In terms of the patient's well being these things may mean a longer convalescence, discomfort on assuming the upright position, and possibly a persistent deformity

Even two weeks at bed rest in faulty positions may be sufficient to bring about contractures of important muscle groups When a joint is held in a certain position without change for such a period of time, it has the tendency to stay in that position

Drop Foot Deformity —Of particular significance in nursing is the fact that the tendon of the muscles of the calf tends to shorten if the foot is allowed to rest in an unsupported position, while the muscles in the anterior portion of the leg become stretched Even a mild degree of this muscular imbalance can cause the patient many long weeks of painful concern with his feet

Conscientious nursing care can do much to eliminate this unnecessary sequel of illness adequate support for the feet (including the toes) should be furnished during confinement in bed, exercises to maintain muscle tone—prescribed by the physician—should be intelligently supervised, and a sensible shoe should be provided when the patient is allowed out of bed rather than soft scuffs or felt house slippers

Knee Flexion Contractures —Another set of muscles that tend to contract quickly is the hamstring group of the posterior thigh, whose tendons pass under the knee Flexion of the knees by continuous supporting pillows may bring about contractures in that area in a surprisingly short time The nursing measures to counteract this are quite simple and obvious Pillows under the knees must be used with caution and with constant awareness that the position of the knees must be altered from flexion to extension at frequent periods during the day and night

Hip Deformities (Flexion, Adduction, and External Rotation) —Let us consider the problem of the patient with an acute condition of

tient who has involvement of the hip joint or back A pillow is used to support the uppermost arm, avoiding pressure on the chest The wrist and fingers are maintained in a functional position



Fig 30 —Poor body alignment in the side lying position

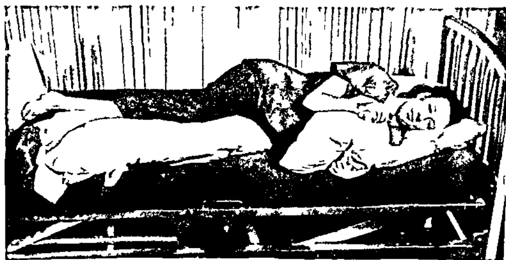


Fig 31 —Good body alignment in the side lying position

POSTURAL PROBLEMS OF THE BED PATIENT

From her study of physiology, the student will remember that in order to move joints, muscles must contract or relax For maintaining the up right posture, however, they must have a *constant,* slight contracture This constant slight contracture is called muscle tonus, or tone To

that pillows are not bunched up under shoulders and head, forcing the spine out of its normal curves. Recognizing the dangers of prolonged outward rotation at the hips, which so often accompanies such bed posture, she will be able to improvise a simple piece of equipment for overcoming this tendency—sandbag, pillow, or a "trochanter roll" made by anchoring a sheet, folded lengthwise, under the patient's hips and rolling it firmly against his thigh and knee. For the feet, if the customary type of footboard does not suffice, she may be able to devise a sling, made of a bath blanket or sheet, folded in a huge triangle and fastened to either side of the bed in such fashion that the feet may rest against it. Pillows placed under the forearms will eliminate the pull on the shoulders. When it is finally permissible to allow the patient to lie flat in bed for certain periods during the day, she will be alert to the necessity of restoring full extension to hips and knees, to overcome the results of long continued flexion in those joints.

Another complicated situation is that of a patient threatened with a sacral decubitus. This is a grave situation, the student realizes, particularly in a thin, elderly patient or one in whom dehydration and pyrexia persist over a long period. The potential danger of pressure areas is always in the mind of the nurse caring for such patients. She knows that they must be averted at all costs. This is one preventive feature of which no nurse is uninformed or neglectful today. Sometimes, however, the problems involved in preventing a breakdown of the skin in the threatened area are so manifold that the nurse forgets the rest of the patient's problem entirely. Perhaps he is turned on his side, where he is allowed to lie a great portion of the time with his legs adducted, his hips and knees flexed. The danger of decubitus is overcome, but no one thinks to place pillows between the thighs for alignment of the extremities. Then one day when he is ready to sit up and walk, it is discovered that he has a dislocation of the hip which lay adducted and unsupported for so long—a crippling condition which will require many months, or even years, to remedy. This outcome is no hypothetical possibility, it has happened enough times to make it essential that the student be taught the important part she plays in the prevention of such disasters. She should be well aware of the response of the musculoskeletal system to disease, to fever, and to disuse. The necessity for good body alignment in bed will become more reasonable and immediate to her as she gains in comprehension of these matters.

Deformities of the Upper Extremity.—Another group of muscles which develop contractures due to faulty or unphysiologic positions in

the abdomen which requires prolonged semisitting in a Gatch bed Such a patient may be in danger of flexion contractures of hips and knees as well as of drop foot If he sits in a slumping position on the lumbar spine, with his chest caved in and his shoulders sagging forward, pulled down by the weight of his arms, pain and muscle spasm are likely to occur in the muscles of the back, particularly those muscles which lie between the scapulae Dr Wright tells us that the muscles most likely to lose tone in this position are the abdominals, the gluteals, the quadriceps and tibials, and the interscapular group—all muscles which will be of great importance to the patient when he once again becomes ambulatory



Fig 32 —Fowler position Support beneath the left arm has been omitted to show position of the body

Even though his surgical condition is such that he must be kept in the sitting position, certain measures can be used which will afford the patient greater comfort and also minimize the aftereffects of his illness If the nurse understands the principles of good sitting posture, she will know that the weight of the body in sitting should be borne on the ischia and the thighs Therefore she will be careful to see to it that the hips are back as far as possible in the angle of the bed, in order to make sure the patient does not slump down and sit on his sacrum or lumbar spine The angle of the bed and the angle made by the flexed hips should be approximated Although flexion of the knees is necessary to relax the spinal extensor muscles, she will be careful to see to it that the knees are extended fully several times during the day She will understand that the back should be supported in its entirety and will see to it

minor details, but it is a mistake to forget that the desperately ill patient may recover Indeed that is one of the primary purposes of nursing to help the patient get well if it is at all possible for him to do so No nurse wants a patient to recover from his original illness only to find that he has another handicap which has come on him because of his stay in bed Our concern for the horizontal man must not allow us to forget the vertical one



Fig 33—Hemiplegia right showing position of arm and hand to prevent common deformities (From Posture and the Bed Patient," by Katherine Allen Courtesy American Journal of Nursing)

Many other deformities come about in patients with debilitating illnesses because they lie in bed over long periods of time in positions of adduction and flexion Flexion, the student should understand, is one of the ways the patient learns to relieve discomfort in his back, his hips, or his knees Sometimes he assumes these positions to keep warm when he has insufficient circulation or covers Good nursing care should be able to overcome at least some of the above mentioned discomforts change of position, support under the low back, a little gentle massage, perhaps, or an extra blanket or hot water bottle in the bed It is sometimes as simple as that

bed are the muscles at the axillary level, particularly the pectoral group Dr Jessie Wright has called the attention of nurses to the fact that patients lying in bed tend to be very limited as far as activity of upper arms and shoulders is concerned Many ambulatory patients, too, are somewhat restricted in this respect The muscles which bring the arms away from the side and those that rotate the arms outward are used so infrequently that considerable disuse atrophy occurs in them The patient with a debilitating illness is likely to lie in bed for many days in the "coffin position"—arms held closely to the sides of the body, elbows flexed at right angles, and wrists crossed and dropped There is usually no reason at all why he must lie thus, he does it out of apathy or lack of knowledge that it may be harmful to him The skillful nurse will find reasons for making the patient use his arms in positions of abduction and outward rotation—reaching upward toward the head of the bed, combing the hair, or fastening the gown at the back of the neck are some simple suggestions At other times she will see to it that provision is made for him to lie with his arms in a position just the opposite of the one he tends to assume constantly that is, with the upper arms away from the body, the elbows extended, the hands turned palm upward By doing this she may be able to prevent the troublesome bursitis and synovitis that have sometimes followed long continued restriction of motion in the shoulder, and she will certainly be able to prevent the tightness in the axilla which so frequently follows long illness If, however, the patient has lain for a long time at home in a restricted position, such activity must be resumed by degrees and with caution

These are some of the mishaps of poor bed posture, but there are others which may occur to cause the patient discomfort if not actual disability after a period of bed rest A sagging bed, for instance, can be the cause of insidious deformity, even though the nurse is careful to arrange the patient in positions of good body mechanics and is conscientious to teach him his part in his own recovery A depression in the mattress at the hip level may bring about contracture of the hip flexor muscles which may make the upright position of full extension at the hips next to impossible

A patient who is gravely ill sometimes receives less attention to his body mechanics than others on the ward It is said, and with some reason, that the problem of keeping such a patient alive takes all the nurse s strength and energy and that effort should not be dissipated on

sult of such a study, and others like it, might form the subject matter for a unit of study in our nursing courses, community health, or sociology. In bringing to the student's mind the situations in the home or hospital that are particularly prone to result in accidents, her horizon for observation is enlarged immeasurably, and a clear comprehension of what constitutes individual responsibility for community health and betterment is not the least of the lessons she has to learn.

In all these considerations, as in all treatment, we have to face the "irreducible and stubborn fact" that patients are human beings; they are not dolls, they do not stay where you put them. They have their likes and dislikes about these things. While we know it is true that positions of good alignment usually produce more lasting comfort for the patient, nevertheless if he has been so long in poor alignment that he has become accustomed to it, a little teaching and persuasion may be necessary. The student must understand that deformity cannot be corrected in a day and that zealousness should be tempered with patience and understanding. The patient's confidence and courage cannot be sacrificed in the attempt to overcome the results of neglect. Overdetermination, nagging, or sharpness demonstrates the fractional approach to the patient's total problem.

GENTLENESS, A FUNDAMENTAL SKILL

If one could be arbitrary at the beginning and point out a single attainment indispensable for the nurse in any service and select it as a major objective for integration into all activities that she performs, one might be tempted to begin with the practice of gentleness. There is not much argument that this is basic and prerequisite for every new skill she will attempt to master. The factor of gentleness as it applies to all the healing arts is too often taken for granted. It is taken for granted that we as decent human beings will treat with gentleness the people under our care. Certainly it is true that no nurse worthy of the name would consciously mistreat a suffering individual, but the acceptance of this as a foregone conclusion that does not need interpretation and emphasis is a questionable assumption. True, there are so many other things that must be learned with great effort—methods, techniques, and manual skills—that it seems we must take some things for granted. Gentleness, we are likely to feel, should be natural and unlearned. So it is that we seldom carry this feature into the foreground of the nurse's mind, taking it for granted that it is there already. Yet this is a habit, and an attitude, that needs developing. Paradoxically enough, we even need to

As the student goes through the clinical services, she will become increasingly aware of situations where her knowledge of elementary body mechanics is of importance. She may see a baby in the obstetrical nursery, whose head seems habitually to rest a little to one side, with the chin pointed in the opposite direction. The baby may normally lie that way part of the time, but is he lying that way all of the time? And does he resist having his head turned the other way? Again, sometimes a patient is observed in an oxygen tent with two or three pillows under his head, but with no support whatever to his back or shoulders. As a result, his chest is concave and sunken. The student knows, of course, that the oxygen is being given to support a failing respiratory system. The incongruity of this in the face of such a sunken and depleted chest capacity should be at once apparent to her. But it will not be apparent unless instruction is given.

Charcot, the great French neurologist, once said, "It is the mind which is truly alive and sees things, but it will hardly see anything without instruction." This wise observation might well serve as a professional axiom for all teachers of student nurses. The difference between a trained observer and an untrained observer is never more important than it is in these instances, but unaided observation has but little value for the young student.

Any position, however adequate it may be as far as posture is concerned, will need frequent alteration. Human beings are not static nor were they ever intended to be; movement is the very sine qua non of life itself. Sometimes these necessary alterations—from one type of good bed posture to another one equally good—will require the utmost ingenuity of which the nurse is capable.

Prevention of crippling, of course, includes far more than attention to bed posture. Disease and accident are the causes of a large percentage of crippling today. The nurse's function in the prevention and control of disease will be emphasized in all phases of her education, but the part she can play in accident prevention may not be so apparent to her unless it is given considerable thought and analysis both in the classroom and at the bedside.

Not long ago, one of the largest insurance companies in this country undertook a challenging task: to determine the cause and kinds of home accidents which occur each year. Accidents in the home cause a high percentage of fatalities yearly. Besides the fatalities there were still to be considered the innumerable disabilities, temporary and permanent, and the resulting economic loss which they engendered. It seems that the re

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type of nursing, for a nurse never goes through a professional career without meeting over and over again the problem of the patient who has been ill a long time—a patient exhausted in courage, short in patience, unreasonable, fearful, and demanding

Many of these problems will be discussed in other sections of the book, particularly those having to do with the care of the arthritic and the care of the aged Nurses who are engaged in working with the chronically ill are urged to read again Florence Nightingale's *Notes on Nursing* particularly those passages having to do with the patient who has been confined to a bed or chair for a long time No one has ever written of this matter with greater feeling and common sense than Florence Nightingale.

There are certain recurring problems regarding the chronically ill which the nurse should bear in mind whether the patient be young or old The very act of entering a hospital, for instance, may in itself be a source of profound apprehension and fear to the patient Perhaps he has had prolonged care in the home, care which he himself directed, wisely or unwisely Every innovation which hospital nurses make is viewed with disfavor and suspicion, often because of the threat it offers to his comfort, but often, too, because the patient has come to take a negative attitude regarding any suggestion of change in his care The student should realize that many of the most characteristic reactions of such patients come from a single source—fear The nurse must recognize that *she* is the exciting cause of this reaction and accept the challenge to eliminate it in the patient's mind

Again, all of us who have been in orthopedic nursing for very long have seen patients forcibly taken out of our hands after a day or two of preliminary treatment by what we justly call unreasonable shortsighted relatives Perhaps a large number of these withdrawals are unpreventable But let us look to ourselves and to the initial treatment we give to cherished children or "sheltered" individuals

To take one relatively uncomplicated situation, there is the case of the young girl admitted for treatment of a curvature of the spine She herself is not disturbed by her back—not yet But the threatened separation from her mother her family, and her schoolmates is a break in her life that looms frighteningly on the horizon The mother's face wears lines of worry They are in very moderate circumstances, they have enough to live on decently but nothing put by for such an emergency as this The very thought of having their beloved child on a "charity" ward, with dozens of other children they know nothing of, is

create respect for it in the student's mind We know that gentleness in the use of the hands is very important When prompted by kindness and understanding it has no counterpart in virtue But these are overworked words—gentleness, kindness, understanding We in the professions become supercilious in the use of them They are adjuncts to the nurse's skill, felicitous for her if she happens to be blessed with them, but not indispensable for a successful career Little emphasis is placed on acquiring them as part of one's necessary equipment for nursing

The practice of gentleness, however, can be a conscious habit, a habit that makes the nurse use her voice and her hands with gentleness consciously because she knows it is good treatment This is thoughtful, objective gentleness, based not on compassion alone but upon the knowledge that sickness is an unremitting source of human fear, and, because she realizes this the emotional components of the patient's illness are as important to her as other common symptoms she has been taught to observe and record

Habitual gentleness is based upon understanding and experience and an ability to identify oneself with the human race It is cognitive as well as conative, based on intelligence as well as emotion It seems that this is too much lost sight of in our nursing Gentleness, whether it is in the handling of an acutely inflamed joint or of the patient tense with fear of an oncoming treatment or pale with apprehension over a suspected malignancy, is a priceless possession But *it cannot be taken for granted that nurses will have this as a gift of God because they have elected nursing as their profession*

Biographers of Sir Robert Jones, the famous British orthopedist, have spoken often, and with deep appreciation, of the *cordial spirit* with which he received and handled his patients They describe his methods of supporting a limb during examination—gently, and with great skill in avoiding movement which would cause pain Part of this skill—the cordial spirit—certainly was from the heart but much of the rest of it must have been painstakingly learned Both characteristics are badly needed by nurses, particularly by those of us working with orthopedic patients

CARE OF THE CHRONICALLY ILL

It has often been said that ward aids and practical nurses give more satisfactory care to the chronically ill than professionally trained nurses If this is true, we need to examine our teaching methods rather carefully and see what it is that we do not give our students to fit them for this

care in the hospital and in the home All of us are *aware* of this necessity, indeed, neglect of it is so shortsighted an attitude that it could not escape attention for long Yet there are still gaps which need to be filled in, gaps which the discerning student will not fail to draw to your attention For the intention to make continuous the treatment given in the hospital with that given in the home is sometimes blocked by lack of a functioning setup to accomplish this Information sent to the family physician may not include instructions as to actual nursing care Sometimes there is an amazing lapse of time between the patient's dismissal and the sending out of instructions for home care, so that the public health nurse is delayed in making her first visit because she does not know the patient is at home Sometimes certain restrictions in hospital rulings prevent any instructions to public health nursing groups at all

Ideally the public health nurse should be informed before the patient leaves the hospital of his imminent dismissal If this were done, she would be enabled to go into the home and assist the family in arranging equipment for the patient's return home She could plan to visit the home on the day the patient was dismissed and be on hand to aid the puzzled mother in carrying out some of the bewildering instructions she received at the hospital when she came to take her child home

Many hospitals have written forms which are mailed out in triplicate before the patient is dismissed one to the public health officer, one to the physician in charge of the patient, and one to the public health nurse

Student nurses should be led to see how vital communications of this nature between the hospital and public health groups are to the patient's welfare Provision for interchange of information should work both ways, the student should understand that the public health nurse may be able to impart much important information as to the patient's attitude and progress during his stay at home when he again returns to the hospital Fortified with this vision, the student will be less likely to think of illness in terms only of the patient's stay in the hospital

can—and will—do things for himself. That is the golden thread that must run through the whole fabric of nursing of the handicapped, as well as through the nurse's teaching of his family. For if there is a tendency on the part of the nurse to protect her patient, to indulge him, and to care for his wants so solicitously that he has no need or inclination to do anything for himself, there is an urge a thousand times more potent in the hearts of the parents of this child, an urge that seems good and natural to them. Re-education of the children of such parents sometimes takes on the nature of cruelty when viewed subjectively. We have all heard nurses who are attempting to do this called cruel and unfeeling. We have heard neighbors call parents cruel who try to create a sense of self-reliance in their crippled child by a little healthy neglect.

CONCEPT OF TOTAL REHABILITATION

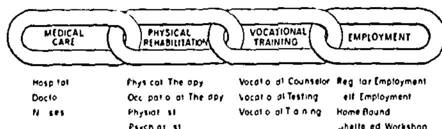


Fig. 31

I once saw a boy of eleven with cerebral palsy who was brought to a hospital by a mother who had cared for him in every exquisite detail since birth. He could neither walk nor talk beyond a few guttural noises. A year later, after an expensive course of treatment which included muscle re-education and intensive training in self-help, that boy went out of the hospital walking unsteadily, but still walking—on crutches. The mother had been told over and over again by the nurses and doctors that all this expensive treatment must be carried on faithfully at home if she had the child's welfare at heart. However, they had but little hope. He was an only child, father and mother were indulgent and emotional and they adored him with what seemed excessive affection.

Two months later, across the street from me, I saw this boy going down the street on crutches, looking as unsteady as a drunken man making his way, his eyes fastened fiercely on the mailbox at the corner which I guessed was his goal. Half a block away I saw that mother

Chapter 2

REHABILITATION

Rehabilitation as we know it today envisions a total effort toward the restoration of physically handicapped persons to a useful life. Total effort means surgical correction, functional restoration through exercise, special education, vocational training and, finally, employment. A team of doctors, nurses, physical and occupational therapists, social agencies, educators, vocational directors, and agencies of employment combine their efforts to meet this responsibility.

Rehabilitation, for the sake of discussion here, will refer to that segment of the total which has to do with the medical responsibilities. Obviously all handicapped persons are not equally capable of complete rehabilitation.

Hospitals in increasing numbers are establishing rehabilitation centers where effort can be concentrated on the purely physical side of restoration. This includes medical direction of physical therapy, occupational therapy, brace fitting, and on the spot work training. A pattern of treatment is available for many known physical defects such as paraplegia, amputations, poliomyelitis, and cerebral palsy that will eventuate in maximum rehabilitation. The Army rehabilitation centers in World War II have shown how special exercises following acute trauma can hasten recovery. Graduated exercise programs including heavy resistance exercise are now a commonplace therapy following operations on bones and joints. The field is so broad that it would be impossible to outline the details here, but discussion throughout this book will include *rehabilitation as applied to specific conditions.*

DEVELOPMENT OF HEALTHY ATTITUDES TOWARD THE HANDICAPPED

There has been enough irresponsible sentimentality bestowed on the handicapped, and we must make sure that the nurse understands the difference between a shallow response of this nature and a realization of the responsibility she must take for her own emotions. Threaded through her orthopedic nursing is the urgent necessity of getting the handicapped individual physically and mentally into condition where he

can—and will—do things for himself That is the golden thread that must run through the whole fabric of nursing of the handicapped, as well as through the nurse's teaching of his family For if there is a tendency on the part of the nurse to protect her patient, to indulge him, and to care for his wants so solicitously that he has no need or inclination to do anything for himself, there is an urge a thousand times more potent in the hearts of the parents of this child an urge that seems good and natural to them Re education of the children of such parents sometimes takes on the nature of cruelty when viewed subjectively We have all heard nurses who are attempting to do this called cruel and unfeeling We have heard neighbors call parents cruel who try to create a sense of self reliance in their crippled child by a little healthy neglect

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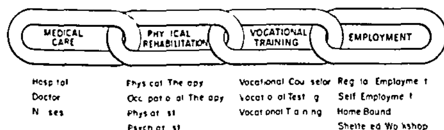


Fig 34

I once saw a boy of eleven with cerebral palsy who was brought to a hospital by a mother who had cared for him in every exquisite detail since birth He could neither walk nor talk beyond a few guttural noises A year later, after an expensive course of treatment which included muscle re education and intensive training in self help, that boy went out of the hospital walking unsteadily, but still walking—on crutches The mother had been told over and over again by the nurses and doctors that all this expensive treatment must be carried on faithfully at home if she had the child's welfare at heart However, they had but little hope He was an only child father and mother were indulgent and emotional, and they adored him with what seemed excessive affection

Two months later, across the street from me I saw this boy going down the street on crutches, looking as unsteady as a drunken man, making his way, his eyes fastened fiercely on the mailbox at the corner, which I guessed was his goal Half a block away I saw that mother

She took on a sort of nobility to me that afternoon—walking slowly, no doubt conscious of every staggering unbalanced effort of her son, but walking a half block behind him God knows what emotions of apprehension and agonized fright were in her heart When he got to the mailbox, he stopped, turned around triumphantly, and waited for her to catch up with him She came on, unhurried and, in attitude at least, calm and unperturbed

In this regard there is the matter of teaching the overprotected individual not only to take care of his own wants in so far as he is able, but also to take responsibility for his mistakes and misdeeds equally with his normal brothers and sisters If the patient has had the benefit of this sort of training at home, the student will recognize how important a thing it is not to do anything to undermine this training because she is sorry for him and thinks that she understands his problems better than his parents Perhaps, however, the individual has not been taught these things at home Perhaps the student has noticed tyrannical traits in the patient when his family visits him In her quiet way she can do a great deal to teach both patient and family The incomparable experience in communal living which is given this overprotected person in the orthopedic ward is not the least of the benefits he will receive in the hospital Sharing his pleasures with the other patients, himself sharing theirs and assuming his part in responsibility for misdemeanors will perhaps be a new sensation to him, but the nurse should recognize it as a chance to use these as the first step in his long fight for social and emotional security The wise nurse points up and makes purposeful these problems of everyday living in the ward Rightly directed, the experience should do a great deal for the crippled person It should help him adjust to other handicapped individuals, to normal companions It should prepare him to live with greater harmony in his own family group It should serve also to overcome a crippled attitude of mind '—a more serious disability after all, than a crippled spine

THE REHABILITATION TEAM

In rehabilitation, the nurse always works as a member of a team The team is composed of all those who are in some way contributing toward the total recovery of the patient whether it be physical psychological social, spiritual, or vocational The team always working under the captaincy of the orthopedist, may consist of the hospital nurse and her assistants, the public health nurse the psychologist the physical and

occupational therapists, the teacher, the social worker, the speech clinician, the vocational counselor, the parents, and, last but not least, the patient himself

When working with a team it is of course extremely important that the common objective be clearly recognized It is equally important to learn *how to work with people* It may often be necessary to subordinate one s own ego for the good of the whole group The complete rehabilitation of a patient may require more of one group of workers than it does of another at certain stages of the program, but there are actually no stellar roles except that played by the patient

Good rehabilitation teamwork demands that the nurse, particularly the hospital nurse, learn perspective The period of time that most rehabilitation patients spend in the hospital is only a small episode compared with the long years he may have been or will be disabled Good perspective requires that the nurse look both backward and forward There was a time, before the disability occurred, when the person who is now disabled lived as a member of a family and a community There was the illness or accident which changed him from a normal individual into one with a handicap There was the period before he decided, perhaps with considerable anxiety and dread, to submit himself to treatment Then there is the brief but intensive period of treatment in the hospital where nurses, occupational and physical therapists, and others work with the surgeon on some reconstructive problem that in itself is only a beginning When it is over, he will return again to his home, his family, his community, to continue the treatment which was begun in the hospital There will be a new group of helpers for him then—perhaps the social worker, the public health nurse, the public health physical therapist Other therapists in a sheltered workshop may be necessary to round out his functional recovery It is a long road and on it the rehabilitation patient meets many people

The more awareness the hospital nurse has of the road the patient has traveled before she sees him and of the distance he has to go before he will have made the maximum recovery he hopes for, the more intelligent and unselfish will be her contribution to the rehabilitation team She will see very clearly that many pairs of hands will be required to assist the patient toward his goal

It is sometimes extremely hard to work harmoniously with other groups when one is under pressure Often it seems that there is endless conflict in aims and method, and one is inclined to feel that there

is a great deal of pulling in opposite directions. It is vital for the smooth functioning of the program that these conflicts be ironed out as soon as they occur. Frequent conferences between groups, with opportunity to thrash out troublesome problems, are bound to pay dividends in easier working relationships, for fundamentally the aims of all the workers, nurses and therapists is the same: to assist the patient in his fight for complete recovery and rehabilitation.

What can the nurse herself do to promote better working relationships with other clinical groups?

First, and this is most important, she can develop a *cordial spirit* for these other people who are working in the rehabilitation area. This area is, in a sense, the nurse's house: she is the mistress. The other individuals who work there are acutely aware of this, and they would like to feel that they are welcome there as part of the rehabilitation family.

Second, she must seek to learn as much as she can about the work of other clinical groups; that is, she should know the aims of treatment, the problems, and many of the skills and techniques which enter into the general care of the patient. It will be necessary that she do her part in encouraging the patient to carry out correctly the instructions agreed upon by the team. Without this follow through, the relatively brief periods the patient spends with the special therapist may be of little lasting value. The nurse must see to it that the patient intelligently and conscientiously practices exercises given him or he may sometimes be tempted to use slipshod methods, knowing that the therapist is not there to supervise him. Furthermore, nurses must work together with these other groups and with the social worker to plan a coordinated home program to fit the needs and capabilities of the patient. Instructions given to parents or patient at the time of discharge should be a joint responsibility and conferences on this subject should be held frequently so that no overlapping or omissions will be likely to occur.

Third, the nurse should see that the patient does not go to the occupational or physical therapy departments, to the school, or to the speech therapist without his basic needs cared for. He should be clean, he should have had a chance to use the bedpan or urinal before he goes. If he is scheduled for walking exercises his braces should be correctly applied and his crutches placed beside him. If he has had an enema which has not been fully expelled, the therapist should be notified before he is sent to the department. He should furthermore be sent to the department on time, and if some unavoidable emergency makes this im-

possible, the department should be notified in order that the therapist be given an opportunity to rearrange her schedule with as little time loss as possible

In conclusion, it must be taken on faith that each worker on the rehabilitation team is trying sincerely to do his or her part toward the patient s full recovery Yet, unless effort is put forth to view the recovery program in its entirety, it may resemble a kind of jigsaw puzzle with each worker concentrating on her own phase of the work to the exclusion of the others The central theme—the unifying pattern—is the patient He is the focal point The pieces of the jigsaw must be fitted together for his benefit so that lines of cleavage are not too evident, and they must be fitted together with tolerance, understanding, and mutual respect, to give satisfaction and dignity to the workers themselves

The whole truth, Steindler once wrote, cannot come from a solitary voice Similarly, planned rehabilitation does not come from a solitary pair of hands The nurse who recognizes this fact and wholeheartedly accepts it will take her place on the rehabilitation team with increased benefit to her patient and greater happiness to herself

PROBLEMS OF REHABILITATION

The basic principles and practices used in giving good nursing care are most applicable and essential to rehabilitation nursing In fact, they are the essence of rehabilitation nursing

Good *hygienic care* is very important for this patient It is not only conducive to good physical health but has value in sustaining morale and a feeling of well being The rehabilitation patient is encouraged and taught to take care of as many of his personal needs as possible Longer periods of time must be allowed for these activities, and an infinite amount of patience is required of the nurse, who works with and encourages the disabled patient to manipulate his own tooth brush, or to manage his own brace What mechanical aids can be used? Can the quadriplegic with weakness of the upper extremities be taught to feed himself, and to light his own cigarette? One no longer concentrates on "doing for" the patient, but one thinks in terms of how can he "do it for himself

Maintaining a state of good *nutrition* is an important aspect of the care of the rehabilitation patient A strenuous exercise program increases his food requirements The paralyzed patient needs adquate intake of protein to help prevent breakdown of the skin and underlying

tissues The individual with arm or hand disability may experience fatigue when feeding himself, and take an inadequate diet unless help is offered The overweight patient must not be forgotten Extra pounds may make ambulation impossible At mealtime, the nurse, who understands what the rehabilitatee is being taught by the occupational therapist, can help him practice self feeding If he can learn to feed himself, mealtime can become a sociable hour This is important for the handicapped person attempting to find his place in family and community life Providing a dining room with tables which accommodate wheel chairs provides a more normal situation for practicing the activities of daily living



A *B*

Fig 35 *A* and *B*—By using the leather holder this quadriplegic is able to comb her hair and to brush her teeth

Regardless of the cause for the illness or disability, the importance of *preventing deformity* is apparent very early in the nursing care Emphasis is placed on teaching the handicapped individual and his family how joint deformity can be prevented The maxim an ounce of prevention is worth a pound of cure was never more applicable than to the prevention of secondary joint deformity Those of us who have seen patients spend weeks (to say nothing of the pain endured) receiving treatment directed at the correction of contractures can well appreciate the importance of their prevention Applying knowledge of good body alignment and of normal joint motion is necessary if deformity is to be prevented

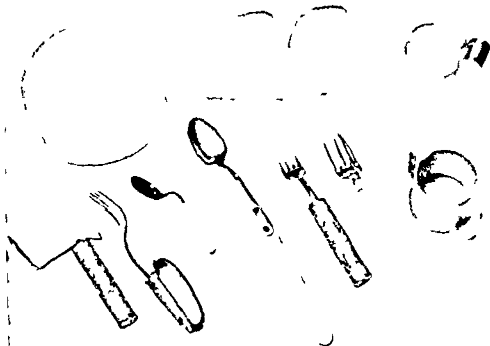


Fig 36 —Mechanical aids which facilitate self feeding for the individual who has weakness or paralysis of the muscles of the upper extremity Suction cup dishes which adhere to the table and which have divided compartments make getting food on the spoon easier Padded or enlarged handles may make it possible for the disabled person to grasp the eating utensil



Fig 37 – This glass holder enables the individual who is unable to grasp objects with his fingers to drink from a glass

Simple *exercises* of the uninvolved extremities must be encouraged and taught the disabled patient early in the course of his care These exercises are valuable in improving circulation, in maintaining muscle strength, and in preventing tightness of tendons and limitation of joint motion As the nurse works with the patient, she may well ask herself, is this patient able to dorsiflex and plantar flex his foot? Is he able to turn his foot in (inversion) and to pull his foot up (dorsiflexion)? This activity is valuable in preventing drop foot and tightness of the heel cord

Can he tighten the quadriceps muscle? This muscle located on the anterior portion of the thigh enables one to brace and extend the knee It is an important muscle in maintaining the erect posture The quadriceps setting exercise is taught with the patient in the supine position and the limb in extension He is instructed to contract the muscles on the anterior portion of the thigh so that the knee cap is drawn upward toward the thigh He holds the muscle contraction for five seconds and then allows the muscle to relax for five seconds The physician may request that the patient do this exercise for five minutes every hour during the waking day Straight leg raising is a second exercise frequently prescribed to strengthen the quadriceps muscle In the supine position with the knee in extension and the foot in a neutral position, the limb is lifted off the bed At first this is difficult, but with practice the limb is raised to form approximately a forty five degree angle with the body This position is held for several seconds and the limb is lowered slowly

If tightness of the hamstring muscles (flexion contracture) is to be prevented the knee joint should not be supported continuously in a flexed position The position of extension must be secured at frequent intervals

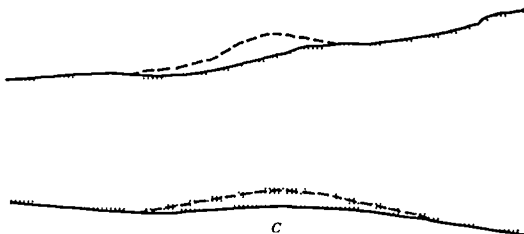
Does the patient lie or sit with his limb in a position of external rotation? A sandbag or trochanter roll placed along the lateral aspect of the thigh will remind and encourage him to maintain his limb in a neutral position

Does he like to have the back rest elevated, or does he sit in a chair for long periods? To avoid flexion contractures of the hips he needs to lie (on a firm mattress) with the hips in full extension

Can he abduct and externally rotate his arms to tie his gown strings, and to comb his hair, or have his pectoral muscles become tight?

Is full extension of the cervical spine attained at intervals throughout the day and night, or is the patient lying with marked flexion of the neck? Frequently patients like this position, as it facilitates their seeing

B



C

Fig 38.—Quadriceps setting exercise *A* Relaxed thigh and knee joint *B* quadriceps muscle located on the anterior thigh is tightened and shortened moving the patella proximally *C* illustrates movement of patella proximally, and pressing of popliteal space against the mattress (*A* and *B* from Gould, Marjorie L Nursing Care—Internal Derangement of the Knee Joint American Journal of Nursing May 1956 By permission of the American Journal of Nursing)

about the ward However, the nurse needs to remember that this position for long periods of time is not conducive to good posture and does not encourage normal respiratory expansion

There is no better place than the ward for the rehabilitation patient to practice *activities of daily living* Whether the task be that of learning to brush his teeth or getting from the bed to a chair, or doing exercises in preparation for crutch walking, the nurse who keeps herself informed as to the plan of treatment and the progress that the rehabilitation patient is making can render valuable assistance to her patient and to her co workers on the rehabilitation team

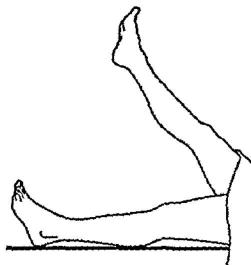


Fig 39 —Performing straight leg raising exercises develops the strength of the quadriceps muscle (From Gould Marjorie I Nursing Care—Internal Derangement of the Knee Joint American Journal of Nursing May 1956 By permission of the American Journal of Nursing)

It is essential that members of the rehabilitation team have knowledge of *resources*, local, state, federal, and private, which may be utilized in the field of rehabilitation The past few years many facilities have been made available and as the need is recognized and as the number of personnel trained in this area increases, the assistance which may be extended the disabled will increase many times The worker, who keeps himself informed of available resources will be able to offer the patient valuable assistance, as he travels the road of rehabilitation

Teaching the patient and his family is an important aspect of rehabilitation The patient learns that good skin care is essential to prevent pressure areas He learns that his position must be changed and that wrinkles and crumbs may cause breaks in the skin He inspects

the skin for redness or blisters which may come from shoes or braces He knows that poor position results in deformity, and that lack of exercise means stiff joints He recognizes the necessity of adequate intake of fluid for prevention of kidney stones, and he learns how to care for his catheter properly He practices applying his brace, dressing himself, and taking care of his personal needs To be successful, rehabilitation has to be a learning process for the patient and his family The disabled person must learn to accomplish many of the activities of daily living by new methods

The nurse on the rehabilitation team has a better opportunity than any other member of the team to know and understand the patient and his family She recognizes that this individual's family will experience emotional strain and will need to make adjustments, as well as the person involved How will they react to the situation? Throughout this period of adjustment a trained clinical psychologist will be of valuable help to the family and patient in working through their problems and apprehensions However the rehabilitation worker recognizes that the individual and his family need to be realistic about his disabilities False hopes must not be fostered They must realize that certain handicaps do exist, but that remaining abilities and capacities can be defined, guided, and developed The regime of treatment should be such that the patient is given the opportunity and motivation to do as much for himself as is humanly possible This includes the privilege of making his own decisions and taking responsibility for his own acts Day by day improvement may seem very small, discouragement and an attitude of futility must be combated from the beginning

Briefly then the ordinary activities required for daily independent living must be painstakingly relearned by the patient These will include sitting, bending, turning, getting out of bed, walking, climbing stairs, putting on clothes and braces, and all types of personal care The program to develop these skills is highly complex experience and a high degree of skill are required to teach them effectively Nurses should know what the system is so that they may constantly encourage and instruct the patient in his struggle for physical independence

FAMILY AND JOB ADJUSTMENTS

The other factors in the total rehabilitation of these patients—particularly those having to do with family, social, and job adjustments—are fully as important as the physical aspects of the task The advancement made since the war in this matter has been heartening Many

new types of jobs have been discovered in which these patients can contribute almost as much as a physically normal person Sheltered workshops and shops attached to hospital wards have been set up in some communities and are used by local industries for piecework such as construction of radio and airplane parts Weaving, watch repairing, typing printing, metal and leather crafts, painting, and wood carving have always provided occupation for patients with severe orthopedic handicaps and have in many instances provided a means to earning a livelihood Factories in many communities have sent small machinery to hospital workshops to be assembled by the handicapped individual Watch and radio repairing are within the grasp of all but the most severely involved patients

Family acceptance of the severely handicapped individual, accompanied by an understanding of his need to live his own life as much as is possible, is probably the most important factor in the total rehabilitation program All the splendid work accomplished in the hospitals and workshops can be nullified in the home if oversolicitousness, rejection, or pity are evident to the patient Nurses will need the help of social workers and social agencies to work out the problem of family adjustments for these patients

The problem of caring for an occasional disabled patient is indeed a most perplexing one for the nurse But if she is fully cognizant of the dangers and armed with knowledge of means to overcome them she will be able to play an important part in his early physical rehabilitation Indeed her efforts may be fundamental in that they actually may keep the patient alive If she is also imbued with a determination to help the patient to become as independent as it is humanly possible for him to be she will no doubt be able to secure assistance from others more skilled than she to aid the patient at various stages of his progress

OCCUPATIONAL THERAPY IN ORTHOPEDICS

Occupational therapy may be defined as any activity, physical or mental which is definitely prescribed and guided for the distinct purpose of contributing to and hastening recovery from disease or injury briefly speaking, it is remedial activity Therefore the goal of an occupational therapist for an orthopedic patient is restoration of physical function This is specific for each patient in the restoration of joint motion, in the regaining of muscle strength or in the promotion of coordination The general aim with all patients is the development of work tolerance, socioeconomic adjustment, and prevocational testing

Fig 40 —Adjustable rug weaving frame for use by the bed patient This type of activity not only appeals to the patient but provides valuable exercise for arthritic fingers wrists elbows and shoulders



Fig 41 —Using modeling clay for finger mobilization Sponge rubber may also be used to strengthen finger muscles

Fig 42 —Arrangement of belt making equipment for the bed patient This activity provides muscle strengthening exercises and joint motion for the fingers and arm

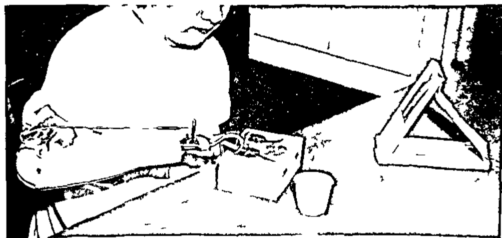


Fig 43 —Upper extremity amputee learning to perform fine movements with her prosthetic appliance

Certainly the psychological manifestations of the orthopedic patient must not be overlooked The tendency of a patient to withdraw from society or to dwell on the pain and problems he may have is not a healthy attitude The occupational therapist substitutes an activity for inactivity, thus preventing this regression into himself and promoting a good adjustment to hospitalization

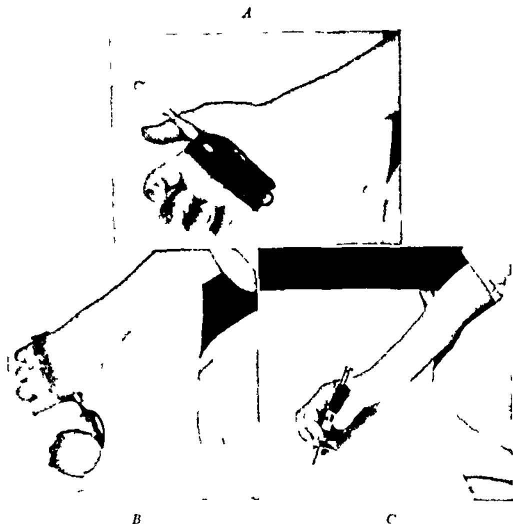


Fig 44 *A B* and *C*—The leather holder with pocket for holding spoon pencil or other utensil is helpful for the person who has lost the use of the small muscles of the hand but still has some shoulder and elbow motion

The media used in accomplishing these objectives are varied Too frequently there is a wrong impression created when a patient is observed busy with a craft The craft is noticed, the activity is not The *occupational* of occupational therapy" is not the project the patient is doing, nor is it his vocation or avocation upon leaving the hospital, but

Fig 45.—The handicapped person with flail upper extremities may learn to use the typewriter by utilizing a mouth stick. The stick is made of plastic material and has plastic covered padding which facilitates holding in the mouth and provides protection for the teeth.



Fig 46.—The disabled person who possesses the use of his fingers but has weakness or paralysis of the arm and shoulder muscles may find this suspension sling helpful in performing activities of daily living.

A

B

Fig 47 *A* and *B* — The individual with shoulder elbow or *hand disability* finds these boards most helpful in practicing and mastering activities essential to everyday living The boards may be raised or lowered and contain such articles as light switches water faucets doorknobs lock, *and telephone*

rather the *occupation* or activity *of mind and body* Use of the arts and crafts is a very valuable method employed by the occupational therapist, but it is only one of many Adapted recreational activities and self help training in dressing and feeding skills are other important means Writing use of telephone, manipulation of doors, latches, dials, and similar activities for daily living are taught to the handicapped patient



Fig 48—Spastic cerebral palsy patient using educational toys for eye hand co ordination exercise

The media used are selected with the patient in mind at all times The referring physician's aim and the patient's involvement, interest, background, age, sex, and many other factors must be carefully reviewed

Occupational therapy plays a coordinating role in the total rehabilita tion of a patient It bridges the gap from total hospitalization to life outside the hospital in that it enables the patient to realize his own

abilities and to carry out the practical actions learned in physical therapy. It prevents the disability that often comes from disuse, it encourages the development of latent abilities and training in prevocational skills, and it develops work tolerance.

DIVERSIONAL THERAPY

The importance of the diversional aspects of occupational therapy should loom larger in the student's thinking than it commonly does. Pointing up of principles learned in her mental hygiene classes may be necessary in order to create in her an awareness of the importance of this feature of the care of the handicapped. She should have some conception from this course—and perhaps from her own experience—of the mental hazard which accompanies "too little to do, and too much time to think." But under the pressure of her ward work—in the midst of the thousand and one calls on her during a busy period in the day, values sometimes become confused and such diversional therapy takes on the aspect of a frill or luxury treatment. This is where we must direct her thinking toward a broader conception of what it means to the handicapped person to be given something to make or to do, to fulfill the essential drive toward productivity which, consciously or not, every human being possesses. To underestimate this need, to adjudge it secondary to the patient's need, say, for a daily bath, is an abysmal misconception. *Baths* can be frills. The need for productive activity is a fundamental need. Therapeutic treatment which is part of the rehabilitation of the handicapped individual's physical capacities is hardly less important, and its scope needs to be made known to the student early in her orthopedic nursing course.

EDUCATION FOR THE CHILD WITH A HANDICAP

In order for her to evaluate the place of community activity in the care of the crippled, she should be guided toward interest in such community agencies as exist for the rehabilitation of the handicapped. She should understand that the need of education for the crippled child is very imperative, perhaps more so than in the case of his normal brother. So many ways of being self sufficient and self supporting are open to the normal individual which are barred from the handicapped one, that he must be better prepared in order to fulfill the more limited type of service of which he is capable. The student should understand that the newest conception of vocational guidance and placement puts the emphasis on versatility, rather than on the limitations of the crippled individual. Perhaps the student may one day be able to interest some

earnest civic group with a great urge to help the handicapped, not to buy the twenty second "Iron Lung" for the state, but to take upon themselves the education of some homebound child Services are generally available for the homebound child with two way radio telephonic class communication as well as home teacher service provided by the public school system

PHYSICAL THERAPY

Physical therapy or physical medicine may be defined as that science which deals with the management of disease by means of physical agents such as light, heat cold, water, electricity, and mechanical agents

From ancient times the principle of physical therapy has been employed, but not always on a scientific basis The practices of lying in the sun, rubbing a bruised muscle, and bathing a wound in a woodland stream have led through the years to the development of the present methods of treatment These have an important function and are well recognized in most outstanding hospitals of today

Thermotherapy

Fever Therapy —The fever cabinet is used to produce a mild elevation (100° to 101° F) of the patient's body temperature The treatment usually consists of thirty minutes in the cabinet, during which time the temperature and pulse are recorded at frequent intervals During the course of the treatment the patient is carefully watched, cool

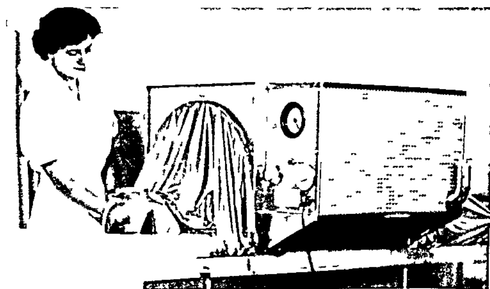


Fig 49 —Fever cabinet

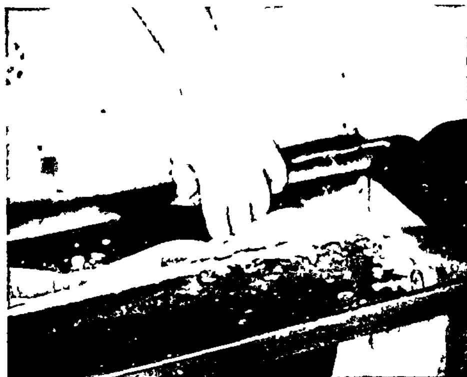


Fig 50—The hand has just been dipped ten times into the melted paraffin



Fig 51—The paraffin glove is being removed This may be put back into the paraffin bath and remelted

cloths are applied to the head, and the patient is encouraged to sip cold water

Fever therapy is used in this way to assist in the treatment of chronic atrophic arthritis Moderately longer and higher fevers have proved successful in treating some cases of acute atrophic arthritis The combined use of chemotherapy and artificially produced high fever has produced satisfactory results in the treatment of gonorrhea and syphilis

Paraffin —Melted paraffin to which mineral oil or white paraffin No 72 oil has been added is very satisfactory as a method of applying heat The melted paraffin is kept at a temperature between 124° and 132° F, if the paraffin is completely melted and has a little scum on the surface, the temperature is correct The dip pack is very satisfactory for treating an arthritic hand or arm, the extremity is dipped down into the paraffin six to ten times until a good thick coat (½ inch) is obtained This, carefully wrapped in a bath towel or bath blanket, will hold the heat twenty to thirty minutes The paraffin can also be painted on the involved area, if alternate layers of paraffin and gauze are used, the resulting pack will hold heat for more than an hour

Paraffin is used chiefly for arthritis, bursitis, fibrositis, or in cases where contractures of the hand have developed Following the paraffin treatment the treated area is well prepared for massage and exercise Paraffin dip treatment can quite easily be carried on at home by heating the paraffin in a double boiler and using the scum test as a temperature guide

Light Therapy

Ultraviolet Radiation —The ultraviolet radiation is in the range of the light spectrum from 1 to 390 milliamperes It can be produced by several artificial sources including the hot quartz mercury lamp, cold quartz lamp or the carbon arc The dosage is governed by the minimal erythema dose (M E D) This is defined as the shortest exposure at a certain distance which will produce a perceptible reddening of the skin within six to eight hours and disappear within twenty four hours Care must be taken to cover the eyes of the patient with moistened pledgets of gauze or cotton and the operator must be sure to wear goggles a conjunctivitis could be a result of not taking these precautions

The above mentioned erythema with resulting increase in local circulation and the well known bactericidal effect of ultraviolet govern its indications It is extensively used in the treatment of decubitus ulcers, infected superficial wounds, and many skin diseases. It has been shown to produce antirachitic effects also

Infrared —The infrared lamp is a simple way of applying local heat There are various kinds and sizes of infrared lamps The energy output which reaches the patient depends upon the wattage of the lamp, the distance from the lamp to the patient, the angle at which the rays strike the patient, and the total area radiated Infrared radiation includes the light radiation from 770 to 220,000 millimicrons The amount used in physical medicine usually ranges from 1,200 to 1,500 millimicrons This includes no bactericidal rays, the main effect being the heating of the local area

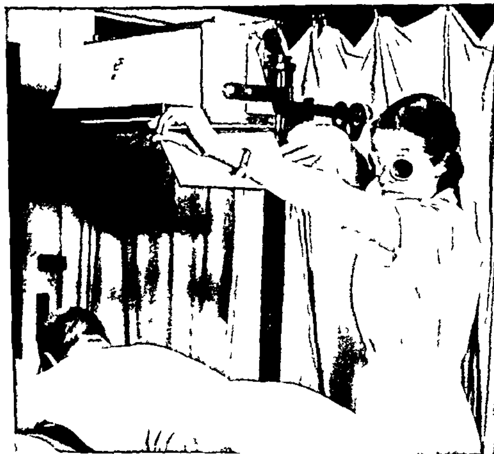


Fig 52 —Ultraviolet lamp being opened for an exposure to the back

Infrared radiations are used in the treatment of arthritis, bursitis fibrositis, muscle strains, and muscle spasms It is a convenient way of applying heat at home

Infrared should not be given following large doses of deep x ray as serious burns sometimes result

Electrotherapy

Electrical Stimulation —Each electrical stimulation machine will give a variety of currents in combination but the main currents used are galvanic and faradic Galvanic current stimulates the muscle and, therefore, will cause a response in cases where the nerve is damaged



Fig 53 —Diathermy coils wound to produce heating to the upper back Care must be taken so that no bare coil touches the patient s skin or another coil

Faradic current stimulates the nerve and can only stimulate a muscle with a normal nerve innervation These currents and their various combinations and derivatives can be used as testing devices to deter mine whether the nerve to the muscle is normal, the extent of the damage, and the rate of nerve rejuvenation Electrical stimulation ap proaches voluntary activity producing approximately the same meta bolic effects, and therefore has proved valuable as a form of exercise to help keep the muscle from atrophying

Diathermy —Short wave diathermy is used to generate heat in the body tissues by means of the resistance offered by the tissues to the high frequency currents forced through them Diathermy can be applied by cables wrapped around the part to be treated or by applying the drums to the area A padding of toweling one half inch to two inches thick is used between skin and electrodes to absorb the perspiration and pre vent any burning Physiologically the effects of short wave diathermy are synomymous with the effects of any other type of heat The only difference is that the hyperemia produced by short wave lasts longer and penetrates the deeper layers of tissue It is used for treatment of chronic sinusitis, mild inflammation of bone, joint, and muscle, chronic osteomyelitis, and various forms of arthritis and bursitis High frequency currents are also used surgically Fulguration and electro desiccation are used to destroy warts and small skin blemishes, electro coagulation is used to remove large tumors and stop bleeding and endosection is useful for surgical cutting by the fine edge of a loop of wire

Hydrotherapy

Therapeutic Pools —To be most useful a therapeutic pool should be twelve to fifteen feet wide and twenty to twenty four feet long It should have walking bars and proper depth to permit walking practice for the patients The temperature of the water depends on the amount of activity the patient will perform, the age and diagnosis of the patient, and the length of time the patient will be in the water If the program is one essentially for exercise, the water could be between 80° and 95° F If a heating effect is desired, the temperature could be up as high as 102° F

Therapeutic pools have proved very valuable in treating convalescent poliomyelitis patients and cerebral palsied children The buoyancy of the water makes it possible for a child to use a weakened muscle through a greater arch of motion Patients can start walking in the walking bars in the pool earlier than out of the pool due to the buoyancy of the water The heat of the water raises the pain threshold so that the patient can tolerate stretching exercises more easily The buoyancy and the heat encourage relaxation of the cerebral palsied patient, and there fore he can perform his exercises with more ease In addition to the physical and physiological benefits from a therapeutic pool, the psycho logical lift to the patients is very valuable He just "feels better" after he has been in the pool and looks forward to the next treatment

Electrotherapy

Electrical Stimulation.—Each electrical stimulation machine will give a variety of currents in combination but the main currents used are galvanic and faradic. Galvanic current stimulates the muscle and, therefore, will cause a response in cases where the nerve is damaged.



Fig. 53.—Diathermy coils wound to produce heating to the upper back. Care must be taken so that no bare coil touches the patient's skin or another coil.

Faradic current stimulates the nerve and can only stimulate a muscle with a normal nerve innervation. These currents and their various combinations and derivatives can be used as testing devices to determine whether the nerve to the muscle is normal, the extent of the damage, and the rate of nerve rejuvenation. Electrical stimulation approaches voluntary activity, producing approximately the same metabolic effects, and therefore has proved valuable as a form of exercise to help keep the muscle from atrophying.

Diathermy —Short wave diathermy is used to generate heat in the body tissues by means of the resistance offered by the tissues to the high frequency currents forced through them Diathermy can be applied by cables wrapped around the part to be treated or by applying the drums to the area A padding of toweling one half inch to two inches thick is used between skin and electrodes to absorb the perspiration and prevent any burning Physiologically the effects of short wave diathermy are synomymous with the effects of any other type of heat The only difference is that the hyperemia produced by short wave lasts longer and penetrates the deeper layers of tissue It is used for treatment of chronic sinusitis, mild inflammation of bone, joint, and muscle, chronic osteomyelitis, and various forms of arthritis and bursitis High frequency currents are also used surgically Fulguration and electro desiccation are used to destroy warts and small skin blemishes, electro coagulation is used to remove large tumors and stop bleeding, and endo section is useful for surgical cutting by the fine edge of a loop of wire

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Fig 54 —By the use of this canvas table routine stretching exercises can be given in the pool as well as underwater exercises and walking practice

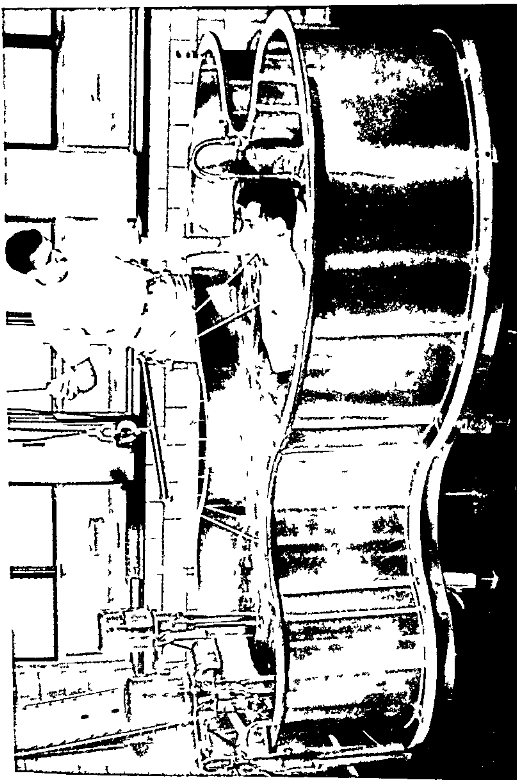


Fig 55 —The patient is lowered into the Hubbard tank by a hydraulic lift

Hubbard Tank.—The shape of the Hubbard tank is such that it permits exercise movements of the arms and legs that are not possible in an ordinary tub. The water temperature is usually kept at about 99° to 100° F for exercise and 102° F for fever. Although a Hubbard tank is not as satisfactory as a therapeutic pool for exercise, it is frequently employed. Since the therapist does not have to be in the pool to care for the patient as he does in a therapeutic pool, the Hubbard tank may be more practical as far as personnel is concerned. The tank may also be used instead of the fever cabinet to induce short fevers. Sometimes a whirlpool agitator is placed in the tank.

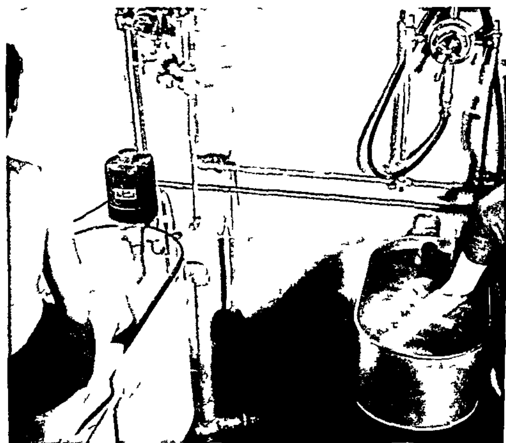


Fig. 56.—Leg and arm whirlpools.

Whirlpools.—The temperature of the water is kept between 100° and 110° F, usually 105° F. The air pressure coming into the water gives the swirling, gentle massaging action to the water. Whirlpools are especially valuable in treating fracture cases or muscle transplant



Fig 57 —Steaming hot towel being folded inside the dry woolen blanket

Fig 58 —Hot packs applied to the back for low back pain

cases after removal of splints. The whirlpool treatment makes it much easier to clean the area of the dry scaly skin, increases circulation to the part, and tends to relieve the pain and stiffness. Whirlpools are also used in the treatment of burns and amputations that are not completely healed. In these cases a mild antiseptic solution is often added to the water. Children can be put into the whirlpool tank for general heating to the entire body prior to stretching and exercises. Whirlpool treatment to arthritic patients has proved very helpful in relieving pain.

Contrast Baths.—In contrast baths the patient's feet or hands are moved alternately from hot to cold tubs of water. The temperature in the hot tubs ranges from 100° to 105° F., and in the cold water from 65° to 70° F. Immersion should begin and end in hot water—four minutes in hot water and one minute in cold. Seven to nine immersions are usually given. The treatment is generally used with arthritis, peripheral vascular disease, and as a preliminary to massage and exercise for sprains and contusions.

Sprays, Douches.—There are many kinds of sprays, douches, ablutions, and affusions used in various hospitals. They are beneficial because of the heating effect or the alternate heat and cold as in contrast baths. They are also used as a refresher after prolonged heat treatment.

Hot Packs.—There are many ways to make and apply hot packs in a hospital and at home. One of the most convenient methods is the one in which a very heavy turkish towel (or two turkish towels sewed together) is heated in boiling water, then quickly wrung out so that as little steam as possible escapes. The pack is then wrapped inside a forty-inch square of wool blanket. In this pack the patient's skin is not touched by the hot towels but only by the dry wool with the steam coming through it. There is no danger of burning the patient if he is carefully dried off between packs. While one set of packs is on, another set should be boiling. The first set is left on three to four minutes and then the second is applied. Three or four sets are usually needed. These packs are easily applied to almost any area of the body either by laying the pack on the area or wrapping it. They have been found to be very beneficial in treating various areas with muscles spasm, strains, sprains, arthritis, and bursitis. Many hospitals prefer hot packs for heat to any of the other available methods.

Mechanotherapy

Massage.—Massage is the term applied to the systematic and scientific manipulation of body tissues for remedial and restorative purposes. It

is essential for the effective application of massage that one has (1) a fundamental knowledge of muscle, joint, and nerve anatomy of the involved part, (2) a knowledge of the desired effects, and (3) a skillful technique and understanding of the various strokes

Physiologic effects of massage on the skin include a sedative effect on the peripheral sensory nerves with a resulting reflex stimulation of motor nerves, a temporary hyperemia and a cleansing of the epidermis The main effect on the muscles is the hastening of the removal of metabolites from the muscle this helps relieve fatigue and spasm Massage will not build up muscle strength, only active exercise can do that Depending on the intensity of the stimuli, massage can produce either a sedative or a stimulating effect on the nervous system It has been shown that massage does definitely increase the pain threshold, this is apparently related to the counterirritant phenomenon As the lymph circulatory system is entirely dependent upon external pressures (normally muscle contraction and joint movement), massage has proved very valuable in helping to move lymph fluid in edematous conditions Massage has a very minimal effect on venous or arterial flow, as the pumping action of the heart is a much more adequate means of circulating the blood More recent literature indicates that massage produces no significant change in red or white cell count or in the hemoglobin in the blood Massage cannot rub away excess fatty tissue", even a very heavy abdominal massage given to animals produced multiple hemorrhages in the area but no change in the amount of adipose tissue Massage is very effective in stretching of excessive fibrous tissue in subcutaneous areas

The massage technique is generally based on the following four strokes

1 *Effleurage* stroking of the surface of the skin The amount of pressure is varied to make it a light or heavy stroking

2 *Petrissage* kneading of the soft tissues

3 *Friction* rotary movements of the skin over underlying tissue The thumb or fingers are kept in firm contact with the skin and the movement is between the skin and superficial tissue and the underlying structures

4 *Tapotement* percussion type movement against bodily tissues This type of massage has very little place in the treatment of pathologic conditions because it is too heavy

To get the best results from a massage, the patient should be in a comfortable, relaxed position The part to be massaged must be supported

and completely uncovered, and the rest of the patient's body carefully draped The operator should be in a comfortable working position Once the massage is started, the therapist's hands maintain contact with the part being massaged until the massage is completed The stroking generally follows the muscle groups The rhythm should be slow and steady, the pressure gentle but firm The heaviest pressure is on the upward stroke (toward the heart, centripetal in direction), and the return stroke is very light Massage should never be painful pain is the prime contraindication for massage Cold cream is generally preferred as a lubricant although cocoa butter is often used for burned or scarred areas and talcum powder over hairy surfaces Any baby oil, olive oil or mineral oil may be used too Considering the physiologic effects of massage, it is used in treatment of arthritis, fibrositis, edema, traumatic conditions such as sprains and strains, fractures, burns, amputations, and various areas of muscle spasm Massage should not be given in cases where you have any acute inflammatory process, skin eruption, malignancy, or fever

Therapeutic Exercise —The aim of therapeutic exercise is to achieve a maximum body function for each particular individual Classified as to type of exercise we have

Passive Exercise The motion is performed by some outside force It may be a gentle, relaxed motion just carried to the patient s tolerance or a stretching motion carried beyond the patient s tolerance to prevent muscle contractures or to achieve joint mobility

Active Assistive Exercise The patient performs the exercises with the assistance of the operator The division of labor should be such that the patient is doing all within his capacity and the therapist gives just the very minimum of assistance or completes the range of motion which the patient cannot do alone An assistive exercise is often given in such a position as to "eliminate gravity" as the weight of the extremity is often too much resistance for the muscle

Active Exercise The patient performs the movement wholly by him self with no aid from outside forces

Resistive Exercise The patient performs the exercise and is resisted by the therapist or an apparatus At the start the resistance is at a mini mum and it is gradually increased as the strength of the exercised muscle increases To gain strength in a muscle as rapidly as possible, it has been determined that the resistance should be sufficient so that ten repetitions of the exercise make the muscle tired In cases of a weak

muscle, manual resistance by the therapist is enough resistance, as soon as the patient can perform the arc of motion against weight, an apparatus may be used In a physical therapy department, regulation apparatus is used, such as a quadriceps boot, back and abdominal resistance harness, DeLorme exercise table, and various pedaling and pulley devices This equipment can be adjusted easily to the proper amount of resistance For home exercises relatively simple devices such as weight bags, pails with sand, scale weights, or window sash weights can be

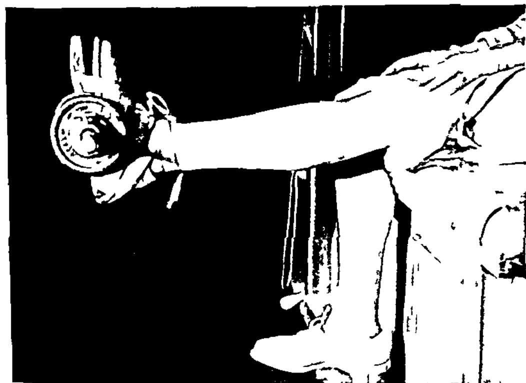


Fig 59—Resistance exercise for the quadriceps muscle Starting position for this exercise is sitting with the legs over the edge of the table and a rolled towel placed under the knee for proper support The leg being exercised is then raised to the position shown in the illustration held there for a few seconds and slowly lowered

adapted to give this resistance As in any form of exercise, the muscle will perform most efficiently if a warm up period is given prior to the maximum effort required A satisfactory pattern for exercise is as follows

Ten repetitions with 25 per cent of maximum weight
Ten repetitions with 60 per cent of maximum weight
Ten repetitions with 100 per cent of maximum weight

To get satisfactory results from any exercise the exercise must be done regularly for a relatively long period of time In most cases this program can only be started in the hospital and must be carried on at home

The scope of therapeutic exercise is indeed broad It includes coordination exercises for multiple sclerosis and cerebral palsied patients, muscle strengthening exercises for many orthopedic and neurological cases, exercises to prevent a deformity as in range of motion activity for an arthritic, to correct a deformity such as a clubfoot, to maintain mobility of joint and muscle as in polio stretching Exercises are given for an esthetic effect as in the treatment of postural defects and to give relief from pain as in cases of low back pain Exercises are given to teach a patient how to relax Respiratory exercises will increase a patient's vital capacity In England a good deal of work has been done with breathing exercises for asthmatics The patient has been able to increase his ability to breathe during an attack and in many cases to prevent an attack Exercises given for peripheral vascular disease will improve the efficiency of the circulatory system

Let us briefly follow a patient in his attempts to ambulate after four months in traction due to a hip fracture During the past several weeks the therapist has had the patient on a series of arm strengthening exercises in preparation for his ambulation The first step will be the tilt table where the patient is strapped across the knees and abdomen and gradually brought from the horizontal to the vertical position He may have crutches to help take some of the weight off his feet When the patient tolerates the tilt table in a vertical position for several minutes he is put on the parallel bars where he learns the proper gait and can practice balancing himself The bars are more stable than crutches and the patient develops confidence in his walking ability When he can walk several lengths of the parallel bars, he is fitted properly with crutches Once he learns the proper gait and develops some skill and endurance in handling his crutches, he is taught to get himself in and out of a chair, to climb up and down stairs, to walk backward and sidewise, and to open and close doors A person on crutches can learn to be very independent and capable of taking care of himself in almost any circumstance This pattern of teaching a patient to be ambulatory is in evidence at many of the stages every day in a physical therapy department

QUESTIONS FOR STUDY—UNIT I

1 Select several pictures from a magazine and study the body alignment Do they represent good or poor body alignment? What criteria of good posture can you cite to support your opinion?

2 Does the furniture in your room (bed, chair, and desk) promote good body alignment and prevent undue fatigue?

3 Cite principles of good body mechanics you will use when doing the following activities moving patient to side of the bed, giving back care to bed patient, assisting patient with tub bath

4 Describe the normal motions at each of the following joints ankle, knee, hip, and shoulder

5 Be prepared to describe or demonstrate good back lying position, good side lying position, good face lying position

6 Explain in detail the nursing care you will provide for the bed patient to prevent foot drop flexion contracture of the knee flexion contracture of the hip external rotation of the hip, adduction of the shoulder joint, and drop wrist

7 Discuss some concrete ways in which nurse and physical therapist may assist each other in the care of orthopedic patients

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Unit II

GENERAL FEATURES OF ORTHOPEDIC NURSING

Chapter 3

NURSING CARE OF CAST PATIENTS

To preserve the efficiency of a cast and, at the same time, to maintain the patient in cleanliness and comfort tax the ingenuity of the best nurse. This skill is one of the most essential of orthopedic nursing, and doctors frequently judge the competency of the nursing staff by the care they give to cast patients. No one way of caring for these patients can be arbitrarily defined, and nurses are daily learning new and better methods. The directions given below are offered solely to the perplexed nurse who has not had sufficient experience in these matters to be able to assume the care of cast patients to her own and the doctor's satisfaction.

The efficiency of the cast—that is, its ability to maintain the position for which it was applied, over the period of time necessary for the accomplishment of the doctor's purpose—is the nurse's responsibility. Yet she must be constantly aware that the *patient* inside the cast is her first concern. One thing she must understand clearly from the outset: the patient's every complaint must have her prompt attention, even though his complaint seems trifling and she may privately consider that particular patient a chronic complainer. The patient who complains seldom will be given solicitous attention when he first begins to complain of a burning sensation over those common points of pressure, the heel, the malleoli, or the sacrum; but it is the patient who complains constantly who may be overlooked, so that when the cast is finally removed a sloughing sore appears over an area he told the nurse about at one time. It is the old "Wolf Wolf" story in an orthopedic version.

OBSERVATION OF CIRCULATION

Nurses have been told so many times about the dangers of impaired circulation in an extremity upon which a new cast has been applied that it seems as though it could be passed over with a word. However,

the alarming number of accidents which occur year after year in the hospital wards from neglect of this extremely serious matter does not justify so optimistic an attitude *It is as important to inspect fingers and toes recently encased in plaster as it is to take a pulse after an operation* Circulatory impairment is as important to watch for as signs of hemorrhage The rapidity with which it may progress from bad to worse is hard for the inexperienced nurse to comprehend Twenty four hours may be enough to produce a paralysis of such seriousness that the patient may never again be able to use his hand or foot

Nurses should be familiar with the blanching sign, which is particularly important in caring for patients who have had leg or arm casts applied The nail of the thumb or great toes is momentarily compressed, and the return flow of blood to the nail is observed The compressed area should refill with blood *immediately* upon release of pressure, that is, the nail should turn from white to pink at once It must be emphasized, however, that some blood often remains in the fingers or toes even after circulation is impaired, and the nurse may be misled into thinking the circulation is satisfactory because blood does return although somewhat sluggishly Doctors warn us that the anemic area must flush *rapidly* with blood, and the fingers or toes should be warm and of good color This inspection should be made every ten to fifteen minutes if there is any sign of impaired circulation

Frequently the physician will cut a hole in the arm cast near the radial artery, his intention being that the nurse take the pulse of the patient frequently *through this opening*, to ascertain whether the circulation to the hand is normal The order on the chart will usually read simply 'Take the patient's pulse every ten minutes" This does not mean that the nurse is to take the pulse to assure herself of the patient's general condition, as she does in other postoperative patients, but rather to keep an accurate check on the condition of the circulation in the extremity in the cast Misunderstanding this order, nurses have been known to take the pulse religiously every ten minutes *on the unaffected wrist*, not realizing the special significance of the order in orthopedic cases Such an order should indicate to the nurse the grave necessity the physician feels of watching circulation in that arm Failure to feel the pulse under the cast is warrant for notifying him at once Symptoms of coldness, pallor, blueness, edema, loss of motion, numbness pain, and a slow return of blood to the part on blanching it with your own finger are cardinal In addition, it is important that the nurse be able to see all the fingers and toes Nor should she be satisfied with twelve

or twenty four hours of close watching *The extremity must be watched during many succeeding days* A feeling of security is not justified because the patient is conscious and apparently in good condition after the operation

CARE OF THE CAST

Supporting the Wet Cast —The care of the patient as an individual, as has been said, is primary, but the cast is important, also The doctor has spent considerable time and thought on the cast From the operating room he sends it back to the ward, often without too much confidence as to the kind of treatment it will receive It is right that the doctor should expect the nurse caring for the patient to know how to protect the cast It has cost both time and money and its importance in the role of the patient s recovery is considerable

The care of the cast begins before the patient returns to the ward from the plaster room It begins with the preparation of the bed A firm mattress is a necessity Boards spread preferably lengthwise under the mattress are essential when the cast is of the body type, or a hip spica, enclosing legs and the body Pillows should be ready to support the wet cast These pillows need to have rubber or plastic covers to prevent dampness and mustiness, which will result from absorption of moisture from the plaster They also need to be pliable and easily adjusted to the body contour If the patient is to have a body cast, three pillows laid crosswise on the bed are usually satisfactory For a hip spica it is best to arrange one pillow crosswise at the level of the waist, with two laid lengthwise for the single leg in the cast If both legs are to be encased, two more pillows will be needed for the second leg if the patient is an adult A pillow for head and shoulders will be necessary if the patient is not having an anesthetic *UNDER NO CIRCUMSTANCES IS THE DAMP CAST TO BE LIFTED DIRECTLY ONTO THE HARD BED ON RETURN FROM THE PLASTER ROOM* One of the chief causes of pressures sores in orthopedic nursing comes from allowing an incompletely set cast to lie unsupported on a hard surface The cast will become flattened over bony prominences, particularly the back of the heel and the sacrum, and damage to the underlying soft tissues is unavoidable

Some doctors like to have sandbags at hand, one to be put under the groin on the affected side another under the heel These are used to prevent too much weight falling on the damp cast It is very essential in any case to see to it that there is no sharp break in the pillow

alignment under the cast, which may cause the cast to sag at some strategic point This is particularly true at the junction of the leg and body sections of the hip spica cast

The patient must be lifted carefully into the bed, not simply rolled or dumped into it Much damage to the cast occurs at just this point The nurse supervising this procedure must see to it that only the palms of hands are used to lift the cast, and not the fingers, which may make indentations in the soft plaster if it is not sufficiently set This is particularly important in handling the foot and leg section of the cast Support should be given all along the cast, particularly under hip and knee, to prevent any cracking at these points

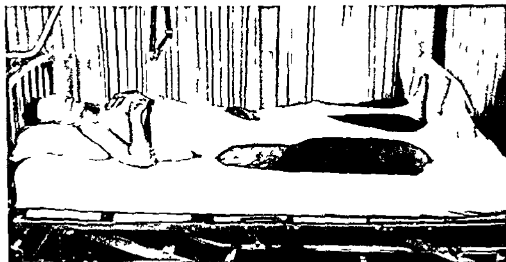


Fig 60—Correct support for the patient in a hip spica cast supine position The pillows beneath the limb enclosed in plaster provide support for the thigh and avoid pressure on the heel The small pad which supports the lumbar region prevents the anterior portion of the cast from pressing on the abdomen and the head pillow placed well down under the shoulders maintains good alignment of the cervical spine Boards beneath the mattress provide a firm surface for the cast Note the trapeze which facilitates nursing care of the patient in a hip spica cast

Drying the Cast—If the patient has not been anesthetized, the cast is usually left uncovered for several hours Many physicians prefer that all their casts be dried in this way, that is, by natural evaporation If, however, quick drying is essential, as often occurs when the patient is shortly to leave the hospital, it can be started as soon as the cast is set A cast should never be baked until it has set, however, for the tempera ture may be raised to the place where setting proceeds exceedingly slowly After the cast has set, it is usually satisfactory to use some form

of external heat for drying it Heat lamps may be used for this, or a cradle on which a low watt incandescent lamp is suspended at a safe distance from the patient and the cast Cages of wire encircling these lamp bulbs are desirable and a distance of at least 15 inches from the cast to the light is usually considered safe The cradle should not be covered with bedclothes or the moisture will go back to the cast as the confined space under the bedclothes becomes saturated Escape for the moisture laden air is essential Another method of drying is by the use of specially constructed cast driers, which usually provide for circulation of air around the cast as well as for heat and are excellent for drying casts evenly and quickly A hand dryer such as is used for hair drying may be employed and is especially good for small areas of plaster which have become dampened through mishaps Intense heat is never recommended as it tends to cause the outer layers to dry too swiftly while the underlying layers remain moist

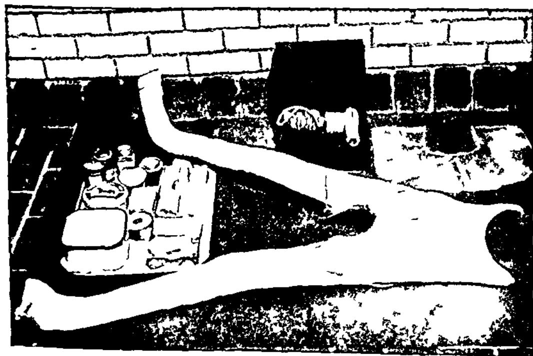


Fig 61 —Bedside cast tray and hair dryer for daily use on casts Anterior shell covered with stockinette and protected with waterproofing

During warm weather it has been frequently observed that, with the early setting and drying process, the cast becomes very hot, so much so that it is sometimes necessary to relieve the patient with ice bags and electric fans to prevent heat exhaustion The nurse will realize that

there is a definite danger of pneumonia particularly if the fan is turned full upon the patient s body If the cast is left entirely uncovered it will greatly hasten the evaporation and hardening, and the heat of the cast will be transitory

It may be well to insert here something about the basic chemistry of plaster of Paris, that the nurse may know exactly what is happening in this cast as it sets and hardens In the excellent pamphlet on plaster casts, prepared by the Curity Research Laboratories, Edward Atkinson says "The crystalline substance, gypsum, is dihydrated calcium sulphate, having the chemical formula $CaSO_4 2H_2O$ In its natural state, gypsum contains about 21 per cent of water of crystallization water (H_2O) which is combined in the crystals of calcium sulphate ($CaSO_4$) When gypsum crystals are pulverized and heated to about 250° F all but about 6 per cent of this water of crystallization is driven off into the air The calcined gypsum which remains is plaster of Paris

"If water is added to plaster of Paris, the reverse action takes place—the plaster takes up sufficient water to replace the moisture driven off by the heating process and crystals of gypsum are again formed "*

The writer comments that what we call a plaster of Paris cast is in reality a gypsum cast 'As soon as water is added to pure plaster of Paris gypsum crystals begin to form During the formation of these gypsum crystals the potential full strength is determined according to the closeness with which the crystals interlock during their formation ' The maximum strength is obtained only after all excess water has been evaporated from the cast s surface When this is accomplished and the cast is wholly dry, it is strong and firm and able to withstand sudden stresses

Turning the Patient—The time of the first turning of the new cast is frequently dependent upon the physician s order but in orthopedic hospitals a standing order usually exists that all patients be turned by the evening of the day the cast is applied This is done, first, for the comfort of the patient and, second in order that the cast may be dried on its posterior surface The first turning of a body or hip spica requires more help than will be needed subsequently when the cast has become rigid and firm through drying To turn a patient with a new cast alone endangers the cast and should not be attempted if it can be avoided

*From *Plaster Casts Their Preparation in the Hospital* By Edward W Atkinson Curity Research Laboratories by permission of the Lewis Mfg Co —Bauer and Black

With a crew of three people, an adult patient in a hip spica cast can be turned without much risk either to the patient's comfort or to the integrity of the cast The patient is gently pulled toward the side of the bed which corresponds to the leg in plaster, and with newly operated patients who are apprehensive of pain all three of the crew should stand on this side of the bed It is possible to effect this moving by exerting a pull on the pillows beneath the cast When the patient is pulled to this side, two of the crew go around the bed, where if necessary a fresh draw sheet may be started and the pillows arranged to receive the cast when the patient is turned Dry pillow cases may be necessary if the old ones are damp When the pillow cases do not need changing, it is sometimes possible to pull the pillows through part way from under the cast without allowing the cast to drop from them Turning should always be done on the side not enclosed in plaster, or toward the unoperated side if the cast is a double spica The patient is thus turned on his good leg, and toward the nurses who are assisting him One nurse remains on the side of the bed toward which the patient has been pulled, in order to overcome any sense of insecurity he may have from a fear of falling, the other two nurses turn the patient toward them from the opposite side The patient is told exactly what is to be done, and he is instructed to place the arm on which he is turning above his head With adult patients, it may be easier to have the patient keep his arms close to his sides To avoid pressure on the arm on which he is turning, place a folded towel between the arm and the cast The head pillow should be removed during the turning In turning, care is taken to move in unison One nurse places her hands on the shoulder and hip of the patient, the other at the thigh and foot of the extremity in the cast The nurse on the opposite side assists with the turning, pulling the shoulder through as the patient is gently eased onto his face Pillows along the entire length of the cast must be in readiness in order to avoid lifting the patient once he is turned Lifting the cast is exceedingly hard on the patient and endangers the soft cast In addition, it is an unnecessary strain to the nurse's back which can be avoided with a little foresight After the patient has been turned, the nurse should observe his position to see that the toes of the leg in the cast do not jam into the bed A pillow laid crosswise on the bed will provide support for both feet If there is wide abduction in the cast, the toes of the foot in plaster may hang over the edge of the mattress Another point to observe is the position of the body section of the cast If there are too many pillows under the patient's head and shoulders, the plaster may press

there is a definite danger of pneumonia particularly if the fan is turned full upon the patient's body If the cast is left entirely uncovered it will greatly hasten the evaporation and hardening, and the heat of the cast will be transitory

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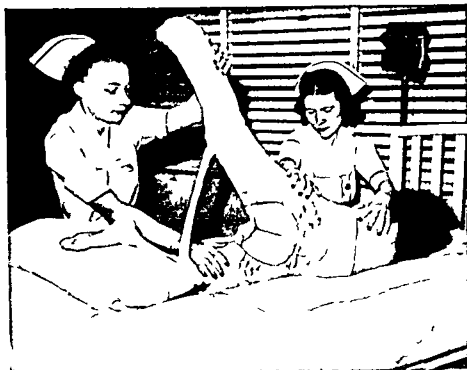


Fig 62 —Turning hip spica cast Note pillow in place for foot support The abduction bar should not be used as a handle when lifting or turning the cast patient

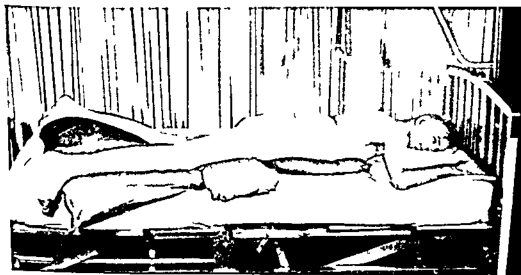


Fig 63 —Correct support for the patient in a hip spica cast prone position The extremity enclosed in plaster is supported by pillows preventing strain on the cast at the groin area There is enough abduction to permit the foot en closed in plaster to extend over the edge of the mattress The thin pillow placed crosswise at the top edge of the cast prevents undue pressure on the abdomen and the one head pillow maintains good alignment of the shoulders and neck Note position of the good extremity

into the back just below the ribs If the pillow under the abdomen is not placed correctly, the cast edges may press into the soft tissues of the chest and abdomen

Later when the cast is completely hardened, one or two nurses may turn the patient with a minimum of difficulty Patients soon learn to assist with their turning to such an extent that little assistance is needed from the nurse or attendant When the cast is dry, pillows are needed only for the patient s comfort and may be dispensed with except over points of pressure A support for the heel so that it does not rest on the bed is usually considered essential, and patients are usually more comfortable with a pillow beneath the body portion of the cast as they lie prone When this is done, the patient's chest will be the forward portion of the body—always desirable for good body alignment

When the patient is turned the first time, the cast will still be damp on its posterior surface and will usually be rather compressed against the back Some method of quick drying should be used at this time, and the patient s back should be given meticulous care The buttocks will be blue and creased from long lying and will need particular attention The skin around the cast edges and immediately beneath the cast can be reached with the fingers, and this area can be rubbed and gently stretched away from the cast to increase comfort and circulation Any rough edges on the posterior surface mu t be cared for at this time If there is insufficient room for defecation, this should be noted and reported The stockinette lining may be pulled down snugly inside the cast and attached over the cast edges, securing these temporarily with small pieces of transparent mending tape, or adhesive, although the latter will not adhere very well to the moist surface of the cast It is too soon to finish the cast permanently and this will have to be tended to on the following day, but if the patient is a child, some thought must be given to protection of the buttock region It is never safe to hope the child will get through the night without soiling his cast Waterproof material may be tucked under the cast as securely as possible, and will usually suffice for the night without being fastened with tape A scratcher bandage may be inserted under the cast at this time if the patient complains of an itching sensation The patient should be urged to lie prone as long as he can A little encouragement from the nurse may often prolong this period to from forty five minutes to an hour When this rest period is completed he is again turned with the precautions described above

Protection of Casts —The protection of casts from soiling and moisture is one of considerable interest The ingenuity of a generation of nurses has been taxed by this troublesome problem The impossibility of doing it properly made such men as Dr Putti and Sir Robert Jones declare that plaster of Paris could be used for home treatment only with the greatest risks and danger However, the modern nurse can devise many good methods of protecting casts which are also simple enough to make home care of patients in casts not only safe but quite satisfactory

To protect the perineal region against body excretions, a waterproof material such as oiled silk or oiled rayon is often used The inexpensive plastic materials now available also provide excellent protection when they are properly applied



Fig 64 —Lapboard used in cutting petals for finishing cast edges Note position of tape strip It is folded so that the sticky sides are out and then cut diagonally toward the center fold

Waterproof material is cut in strips from four to five inches in width and tucked under the cast around the curved area at the buttocks It is secured on the outside of the cast either with adhesive, mending tape, or a single layer of plaster of Paris this latter method usually not being employed without the consent of the physician Oiled paper, the type used in every kitchen, is a cheap and fairly satisfactory waterproof material Parents taking home children in casts should be told of this and

If the surgeon has ordered a window cut over the abdomen or chest, it is usually wise to wait until the cast is dry before having this done There is a tendency for the cast to break or buckle if this large a window is cut too early The surgeon's wishes, of course, should be consulted in this matter

Finishing the Cast Edges—Perhaps the most common method of finishing cast edges is by the use of adhesive tape To prevent the tape from rolling the cast must be thoroughly dry This usually requires twenty four to forty eight hours depending on the thickness of the cast and the humidity of the air Petals of tape cut round or oval, and about an inch and a half in diameter, are excellent to bind cast edges, or to apply waterproofing Curved edges of adhesive do not roll as easily as square edges When applying the tape, it is important that the edges be pressed securely against the plaster This will aid in preventing the tape from rolling and sticking to the bed linen

Another satisfactory method of "petalling" cast edges is to fold a length of two inch wide adhesive tape lengthwise and cut it through at a 45 degree angle The diamond shaped pieces are then unfolded and applied to the cast with the single point on the outside, the double points on the underside of the cast This method is more economical of time and materials than the use of the circle petals

If stockinette has been used to line the cast, the ideal method of finishing the cast is to pull the stockinette out over the edges and secure with a plaster splint This can be done at the bedside The splint is cut to size needed and immersed in water to moisten It is then placed in the desired position to secure the stockinette If the cast is hard and dry, it is advisable to roughen the surface prior to the application of the splint This, with rubbing, will make the plaster splint adhere to the cast surface

Before finishing the cast edges, all rough spots or irregularities likely to cause pressure areas or irritation of the skin must be removed Also before finishing around the buttocks, be sure that there is enough room for the patient to have proper care after voidings and defecations If the cut out space seems unnecessarily small to you, inquire of the physician before binding it Most doctors are eager to give nurses enough room for proper care of these patients and usually the insufficient space cut out is an oversight rather than a design An exception to this may be in operations where adductor tenotomies are done and the incisions are very close to the perineum

recipe of this mixture is as follows Fill a quart jar two thirds full of cellulose acetate Add one and one half ounces of sizing (dimethyl phthalate), and add enough acetone to fill the quart jar completely Mix this, and stir occasionally It may be necessary to add more acetone if evaporation is rapid The consistency of the material should be that of a thin syrup None of these finishes, of course, will provide perineal protection for the cast, as they do not protect the inside of the cast from excreta They do, however, make it possible to remove pencil and crayon marks and other soiling from the outer surface of the cast and are particularly useful in caring for young children

Casts cannot be washed, as water will soften them and the life of the cast will be shortened and its efficiency lessened Mold will almost inevitably appear on the surface of a frequently dampened cast It is usually considered permissible to remove very minor stains from casts with a cloth squeezed almost dry and rubbed over a cake of Bon Ami If the area is large, this must be followed by some form of artificial heat or sunlight to dry the cast as quickly as possible Shellac, varnish, or lacquer must not be used to waterproof casts until the cast is thoroughly dried, preferably not until forty eight hours have elapsed Waterproofing the entire cast before it is dry prevents the proper evaporation of moisture beneath

Old stockings or underwear may be used to cover casts in the home and provide excellent protection for leg casts in children In some clinics all casts are covered completely with stockinette before the patient is discharged Outer stockinette is sewed to that which has been used beneath the cast as a lining Unquestionably this method does preserve the cast more satisfactorily than any other, but it entails a considerable amount of time, more than is usually available in the modern hospital

It has been suggested that the waterproof material used to protect casts be applied in strips rather than in a solid piece The reason for this is obvious, since a curving surface is to be bound The material is tucked under the cast so that it folds back very tightly, thus forming a dam against excretions, but too much material must not be used under the cast or it will become wrinkled Tape should be applied in such a fashion that the oiled silk can be easily slipped out from under the cast without entirely detaching it

Placing the Cast Patient on the Bedpan —But even with the most artful padding and waterproofing the nurse's worries are not over She

encouraged to apply it to the cast to protect it from soiling and dampness Oiled paper does not have the durability of other waterproof fabrics and must be changed frequently Since it is inexpensive, the labor involved is usually the only consideration Student nurses have been gratified to find parents whom they have instructed in cast care returning with their diapered children in well protected casts, even though the protection was afforded by oiled paper bearing bread labels!



Fig 65 —Basting waterproof pattern around removable hip spica cast shell Pattern is a double semicircle of Pliofilm cut out to fit cast opening and basted together on concave edges before it is applied to shell

For protecting the entire cast, various methods are used Shellac and varnish may be painted on the cast with a brush and will dry quickly White lacquer makes a particularly good surface which has the additional advantage of looking extremely well Some physicians prefer to use a mixture of cellulose acetate to provide a waterproof surface The

will prevent this accident Unless you have a patient who is in shock or hemorrhaging, it is almost always permissible to elevate head and shoulders for use of the bedpan Sharp angulation at the groin must be avoided to prevent breaking the cast A second precaution which may be taken is that of placing a folded diaper or saline pad on the posterior aspect of the bedpan This padding will absorb moisture and prevent the lining of the cast from becoming wet with urine

To place an adult patient on the bedpan, one of two methods is usually employed The patient is turned onto his good side, the bedpan placed so that the fleshy part of the buttocks contacts the posterior section of the pan, and pillows or blankets are arranged in such a way as to support legs and back on the same level as the buttocks The patient is then returned to the back lying position By the other method, with an overhead trapeze to support himself the patient may be placed on the pan without turning The nurse elevates the hips with one hand while slipping the pan under with the other

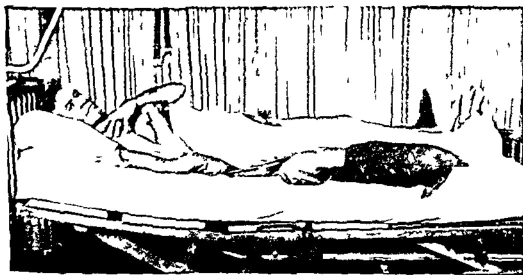


Fig 68 — Placement of patient with hip spica cast on the bedpan To avoid strain on the cast at the groin area pillows have been placed beneath the limb enclosed in plaster and beneath the lumbar and hip regions The head of the bed has been elevated slightly to help prevent soiling or wetting the posterior aspect of the cast

With the small child in the hip spica cast the problem is more complicated A Bradford frame hung on hooks in the crib or supported on boxes is frequently used The frame is prepared with a two piece covering, so arranged that a space is left under the buttocks A bedpan is kept constantly under this space Most orthopedists object to diapers

must still be extremely cautious when placing the bedpan that the buttocks are not higher than the head Inevitably this situation will cause urine to flow backward inside the cast, and the drying out of the cast afterward is no small problem Elevating the head of the bed slightly and placing another pillow under the back while the patient is voiding

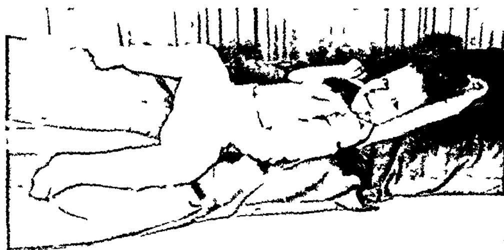


Fig 66—Supine position in hip cast illustrating Pliofilm strips tucked about the perineum A piece of Pliofilm may be tucked over the diaper which is being used as a perineal pad This will help prevent wetting of the cast



Fig 67—Hip cast illustrating position of Pliofilm to protect cast from wetting or soiling The Pliofilm is applied in strips with the outer end secured with tape The strips have been pulled out to permit air to get to the posterior aspect of the cast

to within an inch of the plaster and learn to smell discerningly It takes experience to learn to detect abnormal odors, but sometimes even an inexperienced nurse will be able to locate the exact position of a musty odor which may be the only evidence of a sloughing area beneath It is sometimes possible to detect an underlying pressure sore by the temperature of the cast, for the cast tends to become much hotter over an area that is beginning to discharge *Eyes, nose, and fingers are of equal importance in cast care*

Each time the patient is given nursing care the waterproof fabric around the groin and buttocks should be pulled out from beneath the cast The cast beneath this waterproofing should be inspected for soiling, dampness, and mold Droplets of water adhering to the oiled silk may indicate that the cast was not thoroughly dried before the waterproofing was put on Time should be taken to dry this portion of the cast before the waterproof material is reapplied

The waterproof fabric should be washed with hot soapy water, rinsed, dried and powdered It is then tucked neatly and smoothly under the cast edges If this is done at least once a day, the life of the material will be much prolonged It will also do much to prevent the forming of those small, troublesome pimples that appear around cast edges when the skin and cast are neglected

Certain other areas of the cast patient are commonly vulnerable to pressure sores The heel of the good foot may become sore because the patient habitually pushes himself up in bed by the use of that leg The elbows sometimes become sore because the patient braces himself on them to see what is going on around him These places can be cared for more easily than areas covered by casts and should never reach the stage of skin breakdown

The importance of providing support for the uninvolved extremity cannot be overemphasized The patient is going to need to have his one good extremity in excellent condition to withstand the strain which will be put upon it when he becomes ambulatory Provision for support should be made in the form of footboards, boxes, pillows, or sandbags Bed exercises when prescribed will do a great deal to maintain muscle tone in the feet

CLEANING THE CAST

Adhesive stains which remain after the waterproofing has been changed several times can be removed with benzine applied sparingly on

for infants in hip spica casts, since the diaper serves to spread the urine over the cast and thereby soften it. Many ingenious frames have been reported in the orthopedic literature for keeping the child off the bed with the bedpan beneath the buttocks at all times. But the suspended Bradford frame is probably as efficient as any of the newer types of apparatus.

If the frame is not used, the position of the patient must have considerable attention. The child may be supported on rubber covered pillows, with the body on a slant in the crib. If a diaper is used, it is advisable to fold it in the shape of a perineal pad and to apply it in such a manner that none of the diaper rests on the cast. The waterproof material used around the groin and buttocks should cover a generous area.

Sometimes no stockinette is used for lining the spica cast, and the plaster is applied directly over the sheet wadding and padding. In these cases it is not unusual to find young children busily pulling handfuls of sheet wadding out from under the cast. To prevent this, and to add to the comfort of the patient, small towels may be used to slip under the cast anteriorly and posteriorly. If the cast is rather tight, a tongue depressor or comb may be used to push the towel under the cast, but great care must be taken not to injure the child's skin. These cast towels may be changed daily. Older patients who complain of itching will derive comfort from a long flexible "feeler" which may be wrapped in cotton and dampened in alcohol. Fly swatter handles or corset stays serve this purpose nicely. A wide muslin bandage, single thickness, may be stretched inside the cast. This is the old Lorenz "scratcher"—a device that has never lost its usefulness.

CARE OF THE PATIENT'S SKIN

Good powers of observation are necessary in caring for the patient in a cast. All visible skin must be inspected daily for signs of abrasions or irritation. All areas which come in contact with cast edges must have particular attention, for cast sores are very frequently encountered just at these places. Fingers moistened sparingly with alcohol should explore under the cast as far as it is possible to reach. If beginning abrasions or skin blemishes are noted, they should be inspected frequently during the day. Sometimes collodion based or tar based emollients are prescribed to protect the skin at these points against further irritation. Nurses should learn to inspect casts with the nose as well as with the eyes and fingers. It is not enough, however, for the nurse merely to sniff at the cast as she stands in an upright position. She must get her nose down

through the cast, moistened slightly, and pulled out further as it becomes soiled or saturated Relatively few casts need ever become this badly soiled if intelligent care is given beforehand

On the adult wards where all this elaborate precaution seldom seems necessary, protection may be managed by small squares of waterproof fabric put in place only at such times as the patient uses the pan These squares may be washed and dried afterwards This requires much less use of materials and is usually sufficient, particularly on an adult male ward To risk such underprotection on a child's ward is usually dangerous to the cast, however Nor should too much confidence be placed even in the adolescent girl in spica casts Any patient in a cast is relatively helpless in taking care of his own toilet needs, and the nurse must understand this from the outset of her orthopedic work

ARM AND LEG CASTS

Most of the above admonitions have to do with patients in the larger types of cast, but there are things which must be borne in mind about the patient in the foot or leg cast, or in the arm cast reaching from wrist to shoulders Paramount in importance, as has been stated, is the matter of circulation in the part Arm casts should be supported in a sling if the patient is ambulatory, and it scarcely seems necessary to remind the nurse that a sling should *support* the arm and not allow it to drop forlornly at an angle of 120 degrees at the elbow It must be remembered, too, that the hand and wrist should be supported and not permitted to hang in a "drop wrist" position The weight of an unsupported cast on the shoulder is considerable and will cause the patient decided discomfort which a well applied sling can eliminate In this connection it might be well to remind the nurse of the potential danger and discomfort of a sling tied in a hard knot over the back of the neck so that the knot constantly presses on the cervical spine A sling is more comfortable if it is pinned in two places neatly with two small safety pins, dividing the stress of the weight

Long leg casts should be supported on pillows when the patient is placed on a bedpan, otherwise, the patient will be both insecure and uncomfortable with his legs unsupported in space as his body is elevated to the level of the pan The groin area of long leg casts in children needs protection with a waterproof material

The bathing care of toes and fingers in casts is a point of neglect The patient may be well bathed otherwise and the toes or fingers overlooked

a damp cloth and rubbed briskly over the area The orthopedic nurse should learn to take pride in keeping casts as nearly spotless as she possibly can

However, with all the best care we can give, accidents do happen, particularly with small children Knowing how to repair this damage is a satisfactory accomplishment and seems like nothing short of a miracle to the onlooker

The outside of the cast may be easily repaired Bon Ami, carefully applied with a damp cloth, will remove the most superficial stains For the larger areas of soiling, the pattern" method of repair is recommended From a plaster bandage of suitable width a double thickness of bandage is cut to fit exactly over the soiled area This pattern is swiftly immersed in water and should be barely moistened through when it is lifted from the pan The pattern is applied directly over the soiled area and carefully rubbed into the cast It must be well incorporated by rubbing or it will peel off later like an onion skin Some orthopedists advise that the cast be roughened slightly with a nail file or scissors before the pattern is applied A generous sprinkling of baby powder rubbed into the moistened plaster will remove the odor which may accompany soiling

A more troublesome problem is encountered when the inside of the cast becomes soiled To remedy this the stockinette lining of the cast may be carefully detached from the area around the buttocks or groin, with either a razor blade or sharp scissors The stockinette can then be pulled down and the soiled area trimmed off Stockinette stretches to a considerable degree and this is not at all difficult to manage The clean edge is then brought out over the cast edges and secured to the cast either with adhesive tape or a bit of damp plaster of Paris bandage Repeated soiling of this kind would deplete the available stockinette lining

If no stockinette has been used to line the cast small portions of the sheet wadding must be carefully pulled out and the inside of the cast cleaned with a very sparingly dampened cloth

When new layers of plaster are used to refurbish casts, some drying agent such as a light cradle hair drier or sunlight must be used before waterproofing is again placed on the area This cannot be emphasized too often *Mold is sure to form on damp casts which are covered with waterproof material*

Another method of cleaning the inside of casts is by the use of a single thickness of muslin bandage six to eight inches in width It can be run

Bivalved casts may be aired daily and placed in the sunlight for drying A rack of some description to hold such casts is an excellent thing to have on hospital sun decks An ordinary clotheshorse will serve the purpose nicely, and will hold a number of such bivalved sections The use of such clotheshorses—the collapsible kind that can be stored away when not in use—is also of help in orthopedic wards during baths and evening cares there are seldom enough chairs to hold all of the orthopedic patient s paraphernalia—casts, sandbags, pillows, restraints, et cetera A clotheshorse, placed between two beds, affords a solution for this problem and adds a great deal to the neatness of the ward during the working period

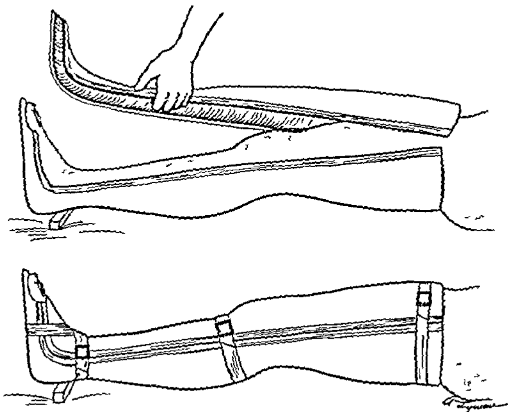


Fig 69 —The bivalved cast Used frequently in convalescent care of fractures sprained ligaments bursitis poliomyelitis arthritis synovitis and many other conditions where protection is still necessary but access to the limb and joints is needed for daily treatments

CARE OF THE PATIENT WHEN THE CAST IS REMOVED

Nurses who have watched orthopedic surgeons apply casts have observed the comfortable support which such casts give the joints Although we may have a private conviction that casts are clumsy things to

Applicators moistened in alcohol can be used to clean, refresh, and de odorize otherwise unreachable fingers and toes Cast crumbs at these points are dangerous as well as annoying They can be eliminated to a great extent by binding the edges around toes and fingers with ad hesive if there is no stockinette to be taped over these edges

ANTERIOR AND POSTERIOR SPLINTS

Quite frequently hip casts are bivalved and made into removable shells in order that the patient may receive the benefits of sun treatment, massage, or exercises If these casts have been on the patient for some time, considerable cleaning may be necessary in order to renovate them A change of stockinette lining may be easily effected without disturbing the cast s padding The cut edges may be bound with adhesive or the entire cast covered with stockinette which can be stitched on Straps are used to secure the bivalved sections securely on the patient's body while he is being turned If a great many such casts are in use of the wards, it is a good policy to keep circular pieces of waterproof material on hand for protection of the gluteal region These are made in various sizes, half circle in shape, and stitched on the sewing machine around the con cave section They may then be turned inside out, and neatly fit into the curved area of the perineal buttocks region Simple basting stitches will secure them nicely to the stockinette covered bivalved shell, or they may be attached with adhesive strips

Frequently, posterior splints or bivalved casts are made to help main tain the patient s extremities in good alignment The splint illustrated in Fig 69 is designed to maintain a neutral position of the foot and limb The posterior shell provides support for the foot, preventing foot drop, and the bar placed at the ankle prevents external rotation of the limb This type of support may also be worn to help prevent flexion contrac tures of the knee It is held in place by an elastic bandage, or figure of eight straps may be placed about the ankle and knee Nursing prob lems, however, are not eliminated with the application of the bivalved cast If not applied correctly the child may pull his foot up within the splint, and the foot is then held in a definite 'drop foot position Sec ond, care must be taken to prevent pressure areas at the heel Even though these casts are lined carefully the heel may be a constant source of trouble Sometimes this can be prevented by placing a small piece of padding, felt or sponge rubber, in the cast just above the heel space This tends to relieve the pressure and will help to prevent blisters or pressure sores

The boards which have been in use under the mattress should not be taken out because the cast has been removed A firm bed is very necessary now to protect the patient from the aches that a sagging bed would cause him

Some physicians feel that support should also be given to the integumentary system immediately the cast is removed If this is done, the edema which so often occurs after removal of a cast can be somewhat lessened All cotton elastic bandages may be used for this, and must be applied immediately after the cast is removed to be effective Other physicians feel that elevating the limb for certain periods of the day may be sufficient to reduce the edema If elevation is ordered, nurses should see to it that support is given along the entire limb, from the buttock to the heel, and that the knee is not acutely flexed

After the cast is removed, movement in bed is usually permitted freely, but certain precautions should be observed Nurses should remember that considerable decalcification has occurred and that the bone is more brittle and vulnerable to stresses which would not affect it under normal conditions Fractures sometimes occur at this time, brought about by very minor stresses, and are sometimes disguised by the patient's general discomfort In addition, muscles which are weakened need careful handling to eliminate unnecessary pain and discomfort Nurses should be careful to lift a limb newly out of a cast by providing adequate support at contingent joints Such a limb should never be lifted by grasping the muscle belly

When plaster casts which have been on the patient a considerable period of time are removed, the skin will be noted to be caked with a yellow exudate that is partly dead skin and partly secretion from the oil sacs of the skin It is generally conceded to be poor policy to try to do much with this skin in the way of softening it or forcibly removing the closely adhering exudate, particularly if a new cast is to be applied at once If the patient is to remain out of the cast permanently, or for a considerable period of time, the skin can be cleaned at the nurse's leisure and the patient s comfort, never forcing the caked matter off in such a way as to cause bleeding or rawness There is plenty of time for this and no one will accuse you of neglect if you allow this to take several days Zeal in this matter is misplaced If the patient is not to go in a cast again at once, olive oil packs on the skin, left on for twenty four hour periods, are an easy and safe method of cleaning up the skin Cocoa butter may be used for gentle massage

handle, the truth is that a well applied cast is about as perfect a fixation apparatus as can be devised for the human body The patient himself may never realize this until he is removed from its support, but once out of his cast, he will become conscious of many aches and discomforts, and even minute changes in the position of the joints will cause him pain Joint structures have become somewhat contracted, and muscles which have been long immobilized are suddenly put on a stretch In addition, circulation is sluggish, and coldness, mottling, and swelling are often present If the primary trouble has been in the hip, the patient may be acutely alarmed because now his greatest discomfort and stiffness seem to be in the knee This is a common occurrence and is usually due to the fact that the quadriceps muscle group, which forms the bulk of the muscle at the front of the thigh, has suffered considerable disuse atrophy from the weeks spent in the cast This muscle group is the main extensor of the knee and is absolutely essential in rising from the sitting position to the upright, standing position When attempting to do this, the patient will be much concerned with the weakness, instability, and pain he experiences in the knee If he can be told that the cause of his discomfort is merely the result of disuse and not a permanent deformity, he will be able to bear it with much more fortitude

To minimize the patient's discomfort, it is necessary to supply support to the patient's joints immediately the cast is removed Slight relaxation rather than complete extension is usually the goal in applying casts, and it is important that this position of relaxation be maintained after the cast is removed The normal curve of the lumbar spine should be supported with a firm narrow pillow or with a sheet folded to make a firm pad approximately six by twenty inches Soft wide pillows do not give the correct anatomical support which is needed at this area The knee should be slightly relaxed by placing a rolled towel beneath the head of the tibia A footboard or box should be used to maintain the anatomical position of the feet, a 90 degree angle with the leg, with the toes pointing toward the ceiling Frequently outward rotation of the hip will be a troublesome feature which may need attention Sandbags placed from the hip to below the knee may be used to overcome this or a trochanter roll may be made of a sheet or bath blanket This is done by folding the sheet lengthwise in quarters, and then folding it in half crosswise The narrow folded end is then tucked under the buttocks and thigh to anchor it in position, and the opposite end is rolled firmly under until it forms a tight roll along the patient's hip and thigh This is an effective method of overcoming outward rotation of the hip

ing until daylight or for the early morning rounds of the house physician Such a policy, while prompted by the best of motives, is dangerous Two or three hours of neglect may do irremediable damage

INSTRUCTION OF PARENTS

What nurses have been taught or have learned through experience and application of their ingenuity about the care of casts is no sacred professional secret It must be shared with all those to whom the care of casts is confided Parents must be given adequate instruction before taking children in plaster of Paris away from the hospital, and this means instruction in all the details that have been mentioned close check upon circulation of the exposed body parts attention to complaints of pressure and burning the manner of detecting odors in casts, the care of the skin under the cast the cleaning and protection of the plaster itself If possible, the parents should observe the patient's bath and cast care completely They must be told that young children often make a game of hiding things in their casts, which may cause damage to the skin They must understand why the patient is wearing the cast and must recognize when it has become inefficient to maintain the position essential to correction of the child's deformity They must be taught how to look for signs that the child is outgrowing the cast If the parent is manifestly slow to understand such instructions and seems confused by the number of things to watch for, instructions of this nature may be written down and sent home with the child On the whole, patients in casts spend but a small portion of their convalescence in the hospital It is but a short interlude, and the excellent care the child experiences while in the hospital will be absolutely negated unless a follow-up of some type is provided for him when he returns to his home The nurse should have enough understanding and sympathy for the parent's economic status not to suggest elaborate and expensive means of cast-protection to a family of very limited means Ingenuity in improvising will be of untold help to the parent and will be a source of great satisfaction to the nurse when she sees later what it has accomplished

Written Instructions for Parents, Pertaining to the Care of Patients in Hip Casts

Even though the plaster cast may seem extremely bulky and awkward, the patient has been placed in the cast for definite reasons, mainly to immobilize the hip joint and to maintain a corrected position Consequently if a definite position of the hip joint is to be maintained, the care of the patient must be such

CUTTING CASTS

Cutting windows or holes in casts is usually considered a dangerous procedure, as the flesh under the opened area bulges out alarmingly after an hour or so and the patient's discomfort is only exacerbated If the doctor in charge of the patient orders such windows cut out, it is customary for him to request the nurse to apply a pad of felt over the area that has been removed, and to use a snug bandage for eliminating this complicating edema Sometimes a window is cut in the cast so that a surgical dressing may be done, or the heel may be cut out to relieve pressure on a tender area In any case, the nurse must not discard the part of the cast removed These pieces are nearly always put back and held in place by a new roll of plaster

Every nurse should know how to cut a cast if an emergency arises The short, curved bladed plaster knife in common usage is not a difficult tool to handle If a cast knife is not available, an ordinary shoe knife, or a pruning knife may be used Very heavy casts may be spread with a household pliers A spoon handle may be inserted under the cast to protect the patient's skin from the plaster knife The spoon is advanced as the cast is cut Vinegar, dilute hydrochloric acid hydrogen peroxide, or citrate of soda are sometimes used to soften the cast before cutting, but most workers feel that water is equally satisfactory The liquid is dropped on the line of cutting with a syringe of the Asepto variety

When an arm or leg cast is to be split to relieve edema, it should be cut along its entire length Splitting the cast only part way will often add to circulatory congestion And it is always a mistake to attempt to prevent or overcome swelling of toes or fingers by cutting the edges of the cast Usually the more the cast is cut or trimmed back, the greater the area which will swell In emergencies, when it is impossible to reach the physician for orders and the edema is such that immediate attention is indispensable, the nurse should split the cast along its full length and spread the plaster slightly It is not enough to cut the plaster only, for frequently the underlying bandages or dressings may be the cause of the circulatory impairment or pain They should be loosened so that no constricting material binds the extremity Where a newly applied cast is split to relieve congestion, it may be taped together loosely until further instructions can be obtained from the physician

It is never safe to postpone reporting circulatory congestion of an extremity in a cast Night nurses sometimes feel that they can risk wait

It takes six to eight strips of the plastic material to protect both back and front of a hip cast on a small child

These strips may be pulled out at the perineum, washed, dried, and powdered daily

(The nurse will provide you with the plastic material and show you how to apply it)

In addition to the plastic material a perineal diaper may be used on the child who is not toilet trained fold a diaper in the form of a perineal pad and place it across the perineum tucking it under the cast edges in the front and in the back The ordinary diaper may be applied over this

It is *essential* that this pad and diaper be changed as soon as it becomes wet or soiled

The small youngster or baby in a hip cast may be supported by placing plastic or rubber-covered pillows so that the head and shoulders are slightly higher than the buttocks This will aid in keeping the cast dry

Placing Patient on the Bedpan

Elevating the patient s head and shoulders by use of pillows while on the bed pan will tend to keep the cast from becoming wet with urine running back from the pan

A folded diaper soft cloth, or saline pad placed on the back of the bedpan will absorb any moisture and will help to keep cast clean and dry It must be removed with the bedpan

Turning the Cast Patient

If only one leg is enclosed in the cast turn the patient toward the good leg (the leg not in the cast) Turn body simultaneously to prevent undue pres sure on the cast at the groin

PLASTER ROOM TECHNIQUE

In cast application, several types of instruments are usually considered necessary Cast knives, cutters, and saws are needed for removing the old cast Bandage scissors will be necessary for removing bandages un der the cast and a heavy pair of shears will be essential for cutting pieces of felt

Sheet wadding, a thin, unabsorbent cotton web, covered with starch to hold it together, is commonly used for padding Piano felt, cut in suit able sizes, is used to provide additional protection against pressure on bony prominences Sponge rubber may occasionally be used for this purpose Material will be needed for re enforcing the cast at points of stress, and aluminum strips, yucca board and plywood are among the most popular of these Tubular stockinette, which comes in many dif ferent widths, from two to eighteen inches, is used for a cast lining A deep pail for soaking bandages, a pan of splints and a waste water ves sel, all of them lined with brown paper or old pieces of cloth to filter the

as to prevent softening or cracking of the cast Equally as important this care must provide for the general welfare of the patient and the prevention of cast sores or bed sores

Skin Care

Special attention should be given the skin of the patient in a cast

1 Daily cleansing of the skin is desirable
2 Reach up with fingers under the cast to eliminate plaster crumbs or other foreign objects
   Feel and look for skin irritations at the cast edges
   Do not permit youngsters to poke crayons or other small objects down in the cast Such articles may cause severe pressure areas
3 Turn patient every four hours during the day time and encourage him to lie on his abdomen several hours each day
   Frequently a patient will find it possible to sleep in this position
   If reddened areas appear on the sacral area the patient must stay on his abdomen more of the time
4 Rub back especially around cast edges and over the sacral area with rubbing alcohol several times daily

Check the Following Closely When Caring for a Patient in a Plaster Cast

1 Is there swelling or discoloration of the toes?
2 Is the patient able to wiggle his toes? Are they warm?
3 Does he complain of pain or numbness?
4 If the patient is a small child does he fuss and seem unduly irritable?
   (If for any reason you are in doubt about any of these things consult your local doctor)

Drying the Cast

If the cast becomes damp it can be dried by exposing the area to the air or by using an ordinary hair dryer

Cleaning the Cast

If the cast becomes soiled from stool, it may be cleaned by using a damp cloth with Bon Ami

Finishing the Cast Edges

To eliminate plaster crumbs in the bed and to provide a smooth, nonirritating cast edge, adhesive tape may be used to bind off the edges of the cast To do this, one must wait till the cast has dried This usually requires 24 to 48 hours

Protecting the Cast From Urine

On the baby or small child plastic waterproof material may be used to protect the cast around the perineum and buttocks

This material should be cut in strips about 4 by 6 inches

One end of the strip is then tucked under the cast at the perineum opening and the material is folded back over the outer side of the cast

The outer end of the material is secured with adhesive tape to the plaster cast

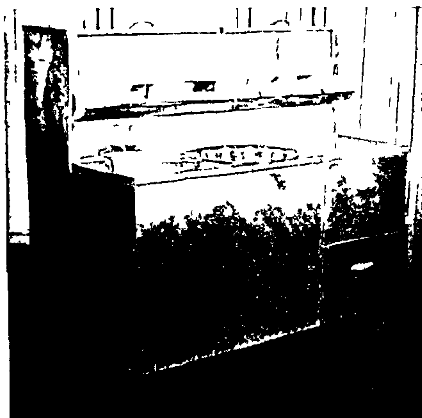


Fig 70.—The plaster cart may be taken to the operating room or to the bed side when applying plaster of Paris

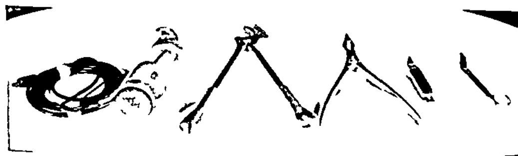


Fig 71.—Cast instruments The cast saw cutter, spreader knife and bandage scissors

waste plaster, will be necessary Gloves and gowns should be at hand for the surgeon and assistants who are to apply the cast The temperature of the water which is used to soak the bandages should be between 95° and 105° F Warmer or cooler water will delay the setting of the plaster

Paper wrapped bandages retain their plaster satisfactorily when they are put on edge until the bubbling ceases They may then be lifted vertically from the water with the ends firmly grasped in the palms Bandages not so wrapped are usually submerged horizontally, with the nurse or assistant keeping her palms cupped over the end of the bandage to prevent loss of plaster No compression of the bandage must take place at this time

The bubbles of air in the water will rise until the bandage is completely wet through, that is, until the water has penetrated every part of the bandage When this is completed, the bandage should be removed immediately as the crystallization (setting) process has begun

The bandage is lifted from the water and held horizontally with the ends secured in the nurse's palms Water is expelled by very gently compressing the bandage in a short twist, no more than it takes to supinate the right hand a single time keeping the left hand in pronation The bandage should not drip when it is handed to the surgeon, but, on the other hand, it must not be wrung so dry that the surgeon will have difficulty in incorporating it into a cast The end of the plaster bandage is unrolled for from two to four inches before it is handed to the doctor Only a very few bandages should be put in the water at one time Change of immersion water may be necessary if a large cast is being applied A waste basin lined with paper, may be used to receive the plaster that is 'wrung' from the plaster bandage when it is removed from the water

By the time the cast application is over, the plaster in the basins used for immersion will usually have settled to the bottom The water above this plaster is poured into the sink with the faucet wide open to assist in washing what plaster is still present in the water through the drain If paper has been used to line the immersion basins this is lifted from the container and deposited in waste containers Garbage pails are used in some clinics, but improvised waste containers may be made of large discarded tin cans Caution must be exercised in the care of all this equipment that plaster is not allowed to gather in the sink and to clog plumbing fixtures

Chapter 4

NURSING CARE OF THE PATIENT IN TRACTION

MODES OF TRACTION

The following brief classification of traction has been inserted to help clarify the student's thinking in relation to the different methods of securing traction

1 *Skin Traction* is applied to the skin and soft tissues and thus indirectly to the skeletal system

2 *Skeletal Traction* is applied directly to the skeletal system The Steinmann pin or Kirschner wire is used in applying traction to an extremity Skeletal traction to the skull is secured by use of the Crutchfield tongs, Vinke tongs, or other device

3 *Manual Traction* means the application of traction to a part of the body by the hands of the operator A student nurse when assisting with the application of traction or a cast may be asked to apply manual traction She should have a smooth firm grip on the extremity and should avoid sudden jerking movements Occasionally when giving nursing care or when traction is changed, it is necessary to apply this type of traction to the extremity Permission to substitute manual traction for the regular traction must be secured from the attending physician

TYPES OF TRACTION

The following types of traction may be described as straight" or running" traction, it exerts a pull on the affected part, but does not provide a balanced support, by means of hammock or splint Buck's extension, rubber surface traction, Bryant's traction

With the following types, the extremity has traction applied and is then supported by means of a hammock or splint held in place by balanced weights attached to an overhead bar Russell traction, balanced traction, Dunlop traction

The following traction is applied with some type of fitted apparatus, such as a corset, Sayre halter, or anklet head traction, pelvic traction, ankle traction

Recently a new substance, melamine polymer, has been used in making plaster of Paris casts A solution is made by dissolving this substance in warm water The solution is then used to moisten the plaster rolls The cast made by using this substance is lighter and stronger than the ordinary cast, dries much more quickly, and is water resistant The water resistant quality makes it especially desirable to use for small children However, this quality does not eliminate the need for protecting the cast The sheet wadding or stockinette which lines the cast, unless protected with waterproof material, may become wet or soiled

The unused solution should be discarded with care It must not be poured into a sink unless there is an adequate plaster trap, and then it should be poured down the drain slowly, with a large amount of running hot water

imposed upon them Such restriction may bring about aches and discomforts or actual numbness that might be avoided by allowing the patient such body activity as compatible with good local immobilization of the affected part However, the traction patient is very seldom allowed the privilege of turning onto either the side or the abdomen It is not possible to maintain any kind of efficient longitudinal traction unless the patient lies in the dorsal position, and lying on the side in particular causes the hips and limbs to sag out of alignment medially Sitting up in bed also diminishes the effect of the traction and is usually not permitted except where threat of hypostatic pneumonia exists, as it may in the aged who are in traction for fracture of the hip

Countertraction —Provision for countertraction must always be made when traction is applied Countertraction can be obtained in two ways Pull may be exerted against a fixed point (such as the pelvis when a Thomas, Hodgen, or Keller Blake splint is used) or pull may be exerted against countertraction in the opposite direction This can be accomplished by elevating the bed under the part which is being placed in traction that is, the foot of the bed is elevated for traction on the lower extremity This will cause the body itself to exert countertraction in its gravitational pull away from the limb extension Elevation of the bed should be from eight to twelve inches If a child or a thin adult is being subjected to many pounds of traction, even this amount of countertraction may not suffice to keep the patient up in bed Other methods must be used One of the most commonly used is the perineal strap, made of tape webbing, padded at a central section for about twelve inches with flannel or silence cloth This padded section passes under the groin, and the ends of the strap are fastened to the head of the bed It serves the purpose well in some patients but in the case of an older child with a congenital dislocation of the hip, where tight adductor tendons are the rule, pressure sores may form rapidly over this area Head traction may be used but it offers additional confinement to an already confined patient and is not resorted to unless absolutely necessary Further elevation of the bed may be of assistance here, and, of course, nurses must be most conscientious in aiding the patient to pull himself up in bed at frequent intervals during the day The footplate or spreader must never be allowed to come in contact with the foot of the bed at any time, or traction on the extremity will become entirely useless

Friction —Any friction created by ropes riding on the foot of the bed, ropes impinged by bedclothes, or heels digging into the mattress will lessen traction efficiency greatly Orthopedic nurses must train themselves

Skill in the care of the traction patient is an attribute that comes with knowledge and experience The patients in casts present their problems, but they are much simpler than the problems of the traction patient The cast patient may be moved as frequently as is necessary for the care of his back or for his comfort He may lie on his back, abdomen, or side without endangering the immobilization of the diseased part Traction patients, on the other hand, usually have but one position to lie in, that is, the dorsal recumbent Good nursing of these patients must include the ability to keep the patient clean, comfortable, and free from pressure sores despite the handicap of his enforced and prolonged recumbency

PURPOSE OF TRACTION

Perhaps the best way to begin studying the care of the patient in traction is to question why a patient is placed in this apparatus What is accomplished by exerting a pull on an extremity or a part of the body? As the student cares for patients on an orthopedic service, she will discover varied reasons for application of traction Frequently she will find that when the physician wishes to immobilize an extremity, traction is applied The diagnosis may be a tuberculous joint, and the desired rest and immobilization is secured in this manner, or it may be a fracture patient, and the traction is applied to the part first to lessen the muscle spasm and to reduce the fracture, and then to immobilize and to maintain the corrected position The arthritic patient who has flexion contractures of the hip and the knee has traction applied to correct or prevent the development of these deformities The scoliotic child may have traction as a form of treatment to lessen the deformity Occasionally the patient with back pain is placed in traction to relieve muscle spasm or it may be applied to lessen muscle spasm about a joint

PRINCIPLES PERTAINING TO TRACTION

Nurses sometimes believe that clumsy insufficient care is the best that can be given these patients However, a definite understanding of the purpose of the traction and its working principle will give the nurse confidence and enable her to care for the patient with greater certainty and satisfaction

Position of the Patient—Often nurses will discover that more movement can be permitted than seems possible on first glance It is good practice to consult the surgeon about the amount of liberty permissible for these patients, for unnecessary restriction of motion should not be

type of traction is mechanically more correct in the case of flexion contracture of the joints than is use of boxes or pillows for support, as the friction engendered by the latter undermines traction efficiency considerably

TRACTION EQUIPMENT

Traction Cart —A traction cart is a helpful device for orthopedic hospitals or wards and will save much time and effort when traction is to be applied Any type of wheeled carriage can be used for the purpose

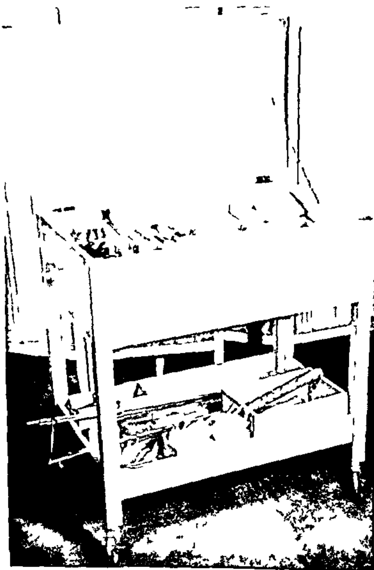


Fig 72 —The well equipped traction cart is a timesaving device when traction is to be applied Traction equipment can be taken to the bedside without delay or preparation

to observe these details and to be on the lookout for others which their experience and common sense tell them mitigate efficiency of the traction A hard, thin pillow, covered with oiled silk and kept well powdered, does a great deal to eliminate bed friction when it is placed under the limb in extension

Continuous Traction —When caring for traction patients the safe rule to follow is that traction cannot be released for any nursing procedure and that it must be continuous for twenty four hours of the day There are exceptions to the above rule, but they must be given by the physician for a specific patient Arthritic patients who have had traction applied to prevent or correct flexion contractures of the joints are sometimes an exception to the above rule and are frequently allowed to be released from traction for a few hours during the day There may be others from time to time who have this privilege, but it is only given on the explicit order of the doctor in charge

Line of Pull —When evaluating traction, one desires, first, to have the pull extending in a straight line and, second, to have the pull in line with the deformity Where flexion contracture of the joint is present, as is so often the case in arthritic and tuberculous joints the traction nurse must realize that a straight pull on the contracted limb is impossible both mechanically and from the standpoint of the patient's comfort Some sort of support for the contracted extremity is necessary so that traction may be exerted in the line of deformity Pillows or a wooden box to support the calf of the leg will accomplish this and can be gradually diminished in height as the contracture of the joint lessens The addition of boxes or pillows means of course that the pulley at the end of the bed must be at a higher level than the foot of the bed will usually permit Some kind of upright bars on the bed, with horizontal cross pieces, will be necessary for traction of this character (Balkan frame)

Frequently in these cases of contracture, an overhead bar or frame with pulleys is used for suspending the calf and thigh, particularly if there is a flexion contracture at the hip level Small canvas hammocks provide support for the leg and are suspended by weights to the overhead pulleys A balance of weights is commonly used at the beginning of the traction period The weights on the overhead frame are gradually diminished, and those on the leg pulley increased as the muscle spasm relaxes and the joint becomes less contracted The doctor in charge of these patients usually attends to this type of traction, as it presents certain responsibilities nurses are not prepared to assume This

tient's hips prevents the free play of the traction rope on the pulley and decreases the efficiency of the apparatus considerably It may furthermore be the cause of a permanent flexion deformity at the hips of the patient who is in traction over a long period of time The bed may be made firm by placing boards beneath the mattress It is preferable that these boards extend lengthwise and that they be hinged at the back rest level

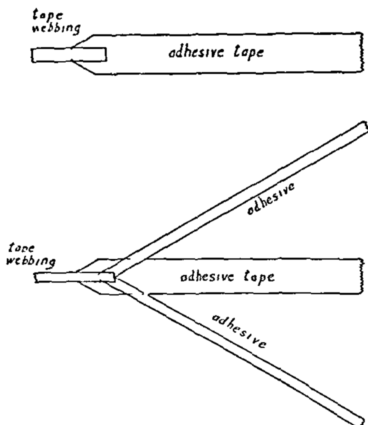


Fig 74 —Two types of adhesive patterns for skin traction *A* Adhesive strip is tapered off and one inch width tape webbing is sewed or stapled onto the adhesive This must be firmly done or separation will occur if considerable weight is applied *B* The three tailed design is also stitched or stapled where the strips adjoin Crinoline is left attached until tape is used but it is not sewed or stapled to the tape

It is desirable, and in most types of traction, a necessity, to have a bed with overhead bars Some hospitals use wooden Balkan frames, which clamp to the regular bed, thus providing longitudinal and cross bars for the pulleys However traction beds may be purchased equipped with the necessary bars and pulleys for the application of most types of traction

The cart may be stocked with various types of orthopedic equipment adhesive strips (on crinoline) sewed or stapled to tape webbing, felt, stockinette bandages (cotton elastic, muslin, and gauze), bandage scis sors, a screw driver, tincture of benzoin, ether, and a razor with several spare blades A lower shelf or a drawer might contain various types of pulleys, weights, and carriers, ropes, footplates or spreaders, sandbags, shock blocks or pins for elevating the foot of the bed, hammocks for limb suspension, pelvic girdles, and chin halters

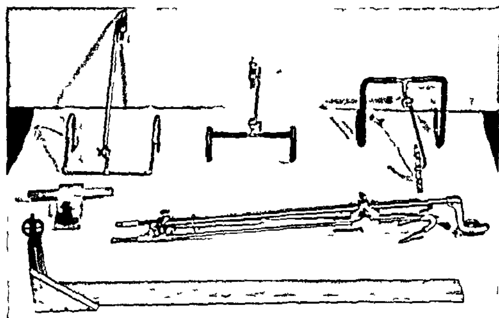


Fig 73 —Types of pulleys commercial and improvised

A basket designed to help the nurse give better daily care to the trac tion apparatus during the patient s bath is also helpful It can contain such materials as adhesive, felt, cotton, stockinette, ropes, oiled silk or Pliofilm, applicators, bandage scissors, screw driver, and needles and thread *Nurses should be encouraged to take this basket to the bedside* when they begin morning care of patients in traction With this equip ment handy, the busy nurse is much more likely to reinforce slipping bandages and to sew on loose buckles than she would if it were necessary to stop and look for the necessary equipment to do these things

Type of Bed —The patient in traction must have a firm mattress that does not sag under his body A bed which sags beneath the traction pa



Fig 76.—The Braun Bohler (inclined plane) splint may be used to support the limb following application of skeletal traction Note that the splint supports the entire thigh and that the knee joint corresponds with the beginning of the inclined plane

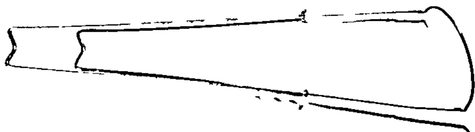


Fig 77 The half ring Thomas splint (Hodgen splint) with Pearson attachment

The trapeze (unless contraindicated) should not be omitted from a traction patient's bed. It facilitates nursing care and enables the patient to do many things for himself.

Shock Blocks and Bed Lifter—As described previously, countertraction is usually obtained by the use of shock blocks. The bed lifter facilitates the placement of these blocks.

One type of Deckert bed is made in such a manner that the head may be lowered and the foot elevated. This makes it possible to get countertraction or shock position without using the blocks to elevate one end of the bed. This device facilitates and saves nursing time.

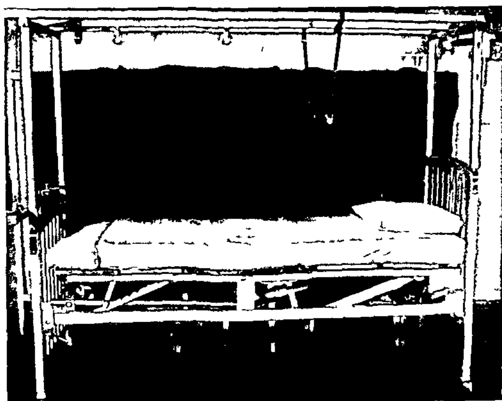


Fig 75—Traction bed. The Balkan frame provides overhead bars for the attachment of pulleys.

Braun Bohler Inclined Plane Splint—The inclined plane splint is frequently used in fractures of the lower end of the femur, either in conjunction with skin or skeletal traction. Since this type of frame and traction rests on the bed it does not maintain immobilization as automatically as a suspension apparatus. The physician should be consulted as to the amount of permissible motion for the patient. As a

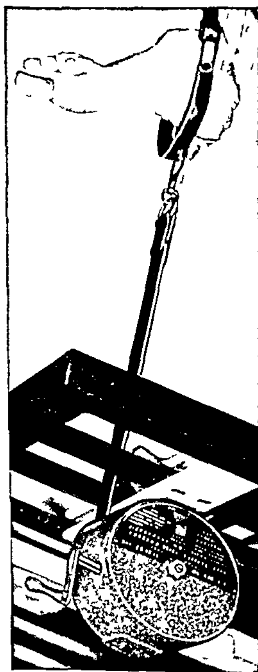


Fig 79 —Hertzmark Adams traction reel Self contained apparatus requiring no weights or pulleys (Courtesy Clay Adams Company, Inc)

general rule, it is permissible to turn the patient toward the splint for back care In changing linen it is more convenient to use two folded sheets for the under part of the bed One sheet rests under the splint,

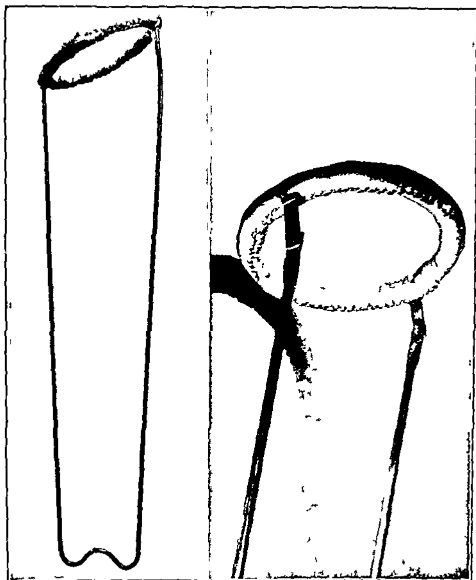


Fig 78 —Thomas splint for lower extremity and modified Thomas splint with hinge for upper extremity (From Speed and Knight Campbell's Operative Orthopaedics ed 3 The C V Mosby Company)

while the other reaches from the head of the bed to the level of the splint It is thus possible to change the sheet under the patient frequently without disturbing the sheet under the splint Two or three

extremity in the proper position and will form a skin tight dressing through which medium traction may be exerted A good formula for skin adherent, known in England as "spirit glue" is as follows

Alcohol	50 c c.
Venice turpentine	5 gr
Benzine	25 c c

This is used with flannel strips for skin traction

The adhesive should be applied with the knee in slight flexion to prevent hyperextension of the joint The tape should cover a generous skin area The largest area of skin and subcutaneous tissue of the extremity is on the thigh, and the traction nurse should plan to utilize all of this, unless her orders from the physician are to the contrary One of the mistakes most commonly made by nurses and young doctors in applying traction is that they do not extend the tape high enough on the thigh A good rule is to extend the tape to the greater trochanter of the femur on the outside, and two inches from the groin on the inside Nurses should learn to know and use such landmarks as the femoral trochanter It is the superficial bony knob on the external surface of the upper thigh, four or five inches below the iliac crest The tape should be measured from this point to a spot about one half inch above the malleolus The tape should never be applied directly to the malleolus but slightly above it Starting the adhesive above the ankle is advisable, also, because it leaves a little room for the tape to slip down, as it inevitably will do for the first twenty four hours If a moderately large amount of weight is used, a downward slipping of the tape for one or two inches may be expected in twenty four hours It is advisable to nick the tape obliquely every inch or so, beginning from the top These nicks should be no more than one quarter inch in depth They are to aid in fitting the adhesive more snugly and neatly to the contours of the leg

The adhesive strips are then applied to the leg on its inner and outer aspects English surgeons advise that the *lateral* adhesive strip be placed slightly back of the midline of the leg, the *inner* strip slightly in front of the midline This tends to overcome outward rotation of the limb, so often a troublesome factor in traction work However, the strips should under no circumstances be allowed to pass over the patella or over the popliteal space—and this may happen if the tape is hastily or carelessly applied The tape is massaged gently onto the skin, and, if circum stances permit, it is well to let a little time elapse between the applica

While pressure upon it will not cause paralysis, the tendon of Achilles must have special consideration No tape should at any time pass directly over this tendon or very near above it The tendon is exceedingly superficial and tends to become sore and denuded with great rapidity An oblong piece of felt placed over this area before applying bandage or traction will eliminate danger to this area

Oblique strips crossed on the tibia at any point are a threat to the underlying skin, and padding should always be applied at these points Adhesive skin traction is not supposed to pull directly on bone it is to be exerted on skin and subcutaneous tissues, and this fact should be borne in mind during its application Superficial bony points are to be guarded

There are a few common errors in the use of apparatus which should be mentioned at this point One of these is the use of a single pulley for more than one rope, a practice which limits greatly the efficiency of the pulley Another is the use of a foot spreader *so narrow* in width that the adhesive tape connecting it to the leg contacts the bony points of the ankle, always vulnerable spots for pressure sores A third error is the use of a foot spreader *so wide* that the adhesive straps constantly pull away from the skin of the leg, thus adding much unnecessary discomfort to the patient

Tincture of benzoin is frequently used for painting the skin before application of the adhesive This has a threefold purpose it serves as a disinfectant for the skin, it gives the tape greater properties of adherence, and it is said to allay itching beneath the tape It is not always safe to apply it to the skin of an infant, because following this the adherence of the tape to the skin is so great that on removing it bleeding points are almost invariably encountered on the baby's skin

In any case, the skin should be dry and clean before the tape is applied, and in cold weather the tape may be laid over a radiator or hot water bottle to increase its sticking power Massaging the tape gently into the skin after its application will prevent much of the slipping that occurs when the weights are applied Wrinkles or creases in the tape are to be scrupulously avoided, as they may be the cause of pressure areas on the underlying skin Ether to dry skin wet with perspiration may aid in helping the tape to stick

There are on the market several new types of liquid adhesive designed for skin traction The coherent is supplied in bottles and is accompanied by flannel strips as a substitute for the adhesive The liquid is applied to skin, and after a stated interval the flannel is laid on the

layers of sheet wadding about two inches wide are wound loosely around the ankle over the stockinette, leaving the edges of the latter free so that they may be folded over the sheet wadding and sewed together with a few basting threads This provides an excellent padding which will neither slip nor fall off



Fig 82—Buck s extension is covered first with sheet wadding Straps are retracted and sheet wadding continued over malleoli as padding Muslin bandage applied over sheet wadding Where traction is being applied for fracture or tuberculosis or other infections of joints manual traction should be exerted during process of applying Buck s extension

With the straight longitudinal adhesive strips unsupported by the transverse sections, a securely applied bandage is needed to maintain the tape in position In many clinics sheet wadding is applied over the adhesive in a simple spiral bandage, followed by a muslin or Ace bandage put on in an ascending spiral reverse In these cases the sheet wadding is brought under the tape webbing at the ankle and provides a nice protection of the bony points It is a point of pride in many hospitals for nurses to be able to apply a beautiful and efficient spiral reverse to the leg However, some orthopedists feel that the upper ends of the tape should be visible at all times in order that slipping may be detected without removing the outer bandage It may be men

tion of the tape and the attaching of the weights Slipping will be much less likely to occur if this is done

As has been stated, the use of these two straps alone is preferred by a number of surgeons This is particularly true in children's hospitals where the delicate quality of the child s skin is a consideration and where only small amounts of weight need to be used to obtain traction In the adult services, some type of transverse or spiral strip is frequently used to re enforce the longitudinal tape For this type of traction a three tailed adhesive strip may be used It may consist of one wide



Fig 81 —Buck s extension (modified) Note notching of adhesive to fit leg contours

piece of tape slit into three sections but undivided at its end, or of three narrower strips stapled together at one end This last forms a neater dressing around the ankles The center strip slightly wider than the other two goes on the leg laterally and medially, as has been described above The other strips are wound around the leg obliquely, as shown in the illustration, with great care to avoid the pressure points mentioned above

A stockinette bracelet for padding the malleoli is an ingenious device used by some nurses A six inch tube of stockinette, about three inches in width, is slipped over the foot encircling the ankle region Several

deserve equal consideration All nurses should know how to tie a square knot and should make use of it in their orthopedic nursing Narrow strips of adhesive tape may be used to make such knots additionally secure

The amount of weight to be used is dependent upon the doctor's order Eight pounds for the adult patient is often used as a beginning, and weight is added gradually after that until a maximum of from 15 to 20 pounds is reached For fractures, very large amounts may be applied at once A large amount of weight should indicate to the nurse that she must be very solicitous about her observations of that patient's traction to assure herself injury to the skin is not occurring at any point Children may have from 1 to 6 pounds of traction at the beginning, according to age and weight

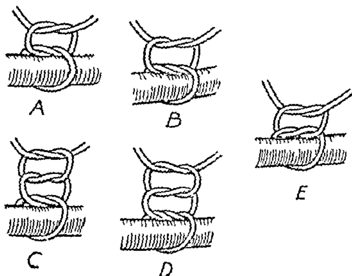


Fig 83—Knots *A* Square knot *B* Surgeon s knot *C* Square knot reenforced *D* Surgeon s knot re enforced *E* Granny knot (From Mobley Synopsis of Operative Surgery The C V Mosby Company)

Orders regarding patients in traction are sometimes confusing to student nurses On scoliotic patients, for instance, it is occasionally the practice of surgeons to order a small amount of weight at the beginning with a substantial increase each day following until a total of 30 or 40 pounds may be exerted on the head and pelvis In fractures, the reverse may be true A large amount of weight is frequently used during the first twenty four to forty eight hours, followed by a decrease in the amount after reduction is obtained In scoliosis, permission is frequently given to remove weights for short intervals during the day, but in frac

tioned here that a figure of eight over the knee, which ordinarily would be used in applying a spiral reverse bandage to the leg, does not prove as satisfactory as a straight spiral or spiral reverse at this point, the reason being that the alternate periods of mild flexion and extension allowed some patients in traction usually displace the figure of eight bandage somewhat Temptation to apply the bandage very snugly to improve its appearance must be firmly resisted Circulation in the foot should be inspected after the bandage has been on for several minutes Signs of mild cyanosis will be present if the bandage has been applied too tightly

Where the three tailed strip is used, a layer of gauze bandage is often applied over the tape for twenty four hours or so The surgeons who employ this type of traction usually request that it not be covered in order that the condition of the skin around the tape may be inspected daily From the standpoint of the nurse, this is most satisfactory, for unless bandages are removed daily it is altogether too easy for pressure areas to form under traction straps with none but the mildest complaints on the part of the patient Needless to say, every complaint from the traction patient deserves prompt attention Here as well as with casts the nose is of definite assistance in detecting the 'musty odor' which may result from pus forming under the bandage

With tape and bandage securely applied, a footplate with buckles or a wooden spreader if no plate is available, is attached to the sole of the foot, it being wide enough to keep the adhesive and tape webbing spread out somewhat from the malleoli A small hook on the bottom of a footplate makes it possible to attach the rope The spreader has a hole in its center large enough for the rope to pass through A square knot on the surface of the spreader which faces the foot secures the rope, and the other end of the rope passes over a pulley secured at the foot of the bed The weights attached to a carrier are suspended on this and must be high enough from the floor that the patient s slipping down in bed will not cause them to come in contact with it If weights are stacked" on the carrier, they should be secured with adhesive strips an inch or so in width, to prevent their slipping off the carrier Canvas bags are sometimes used around traction weights to prevent accidents from loosened knots Weights must not be attached so high that if the patient alters his position in bed the knot will rest against the pulley Rope should be of good quality neither frayed nor pieced together

All knots should be secure The patient's comfort demands that no sudden release of knots occur to jar the leg in traction The nurses' feet

shoe must be very thoroughly padded over the dorsum of the foot, as well as over the heel cord, or skin denuding and circulatory impairment will occur after a few hours in such traction It is not the most satisfactory sort of traction, although it is frequently used because of necessity Applying considerable weight to such a meager portion of the extremity is painful and dangerous The nurse should release the laces over the dorsum of the foot frequently and rub the area with alcohol Ridged blue areas across the top of the foot are bound to occur after a few hours in this type of traction Within twenty four hours, deep fissures have been known to form at this area



Fig 84 —Ankle traction with canvas boot and aluminum footplate This type of traction is intended to be only temporary Prolonged use results in pain and constriction over dorsum of foot and tendon of Achilles

BRYANT TRACTION

Both the Bryant type of traction and the Putti splint have their foundation in bilateral Buck's extension on the child's leg For Bryant traction, two overhead bars passing longitudinally over the crib will be neces ary One or two pulleys are attached to each bar The legs are

tures this would not be permitted The maximum amount of weight for reduction of the fracture is put on immediately, and, once reduction has been obtained, only such weight as is needed to maintain the bone ends in good position is used However, this remaining amount of weight is important and should not be disturbed without specific order from the surgeon

A word should be said here about the danger of constriction of tape in the case of fresh fractures to which traction has been applied Traction for fresh fractures should always be applied by the physician, but the nurse must realize that in trauma of this nature, swelling is bound to occur and an alarming degree of constriction may occur within the first three or four days This must be watched for and reported to the surgeon immediately before any permanent damage can be done to the extremity

RUBBER SURFACE TRACTION

Rubber surface traction requires the same equipment listed for Buck's extension, plus four long strips of soft, porous sponge rubber Three inch adhesive strips are used for the skin traction without spiral reenforcements, and the sponge rubber strips are cut to the exact size of the adhesive The adhesive side of the tape is applied to the sponge rubber and rubbed well until it adheres securely The rubber surface is then applied directly to the skin, as described under Buck's extension and is secured to the leg by means of one or two three inch cotton elastic bandages There is relatively little slipping when the weights are attached, due to the suction of the rubber on the skin The advantage of this type of traction is that the apparatus may be removed for physical therapy treatments and for hydrotherapy Furthermore, it can be used on skin which needs more watching than would be possible if adhesive were applied

However, there are dangers which the nurse must not ignore To prevent slipping the elastic bandage must be wrapped securely This in turn may cause swelling and constriction of circulation This is a real hazard with the older patient, who has poor circulation

ANKLE TRACTION

Ankle traction may sometimes be ordered as a temporary measure This is done with a boot made of leather or canvas laced onto the foot and with straps extending below for rope and weight attachment The

A canvas hammock is often used for the knee sling, but a folded towel can be improvised to serve the same purpose

Adhesive strips form the basis of the traction In the original method, these strips were applied only to the knee Russell believed that it was best to extend the tape only from ankle to knee because he desired that the pull be exerted at the point of insertion of the large muscles of the thigh into the tibia and fibula—namely, the hamstrings and quadriceps However, many modifications to this original method have been worked out by American surgeons during the past few years

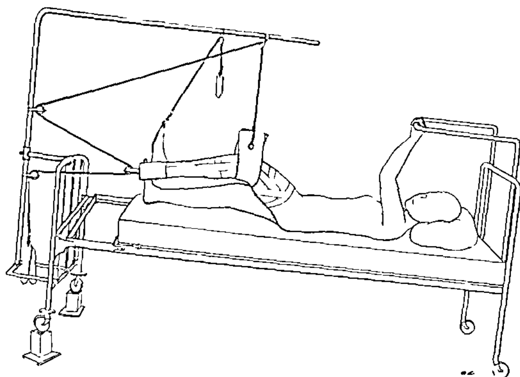


Fig 86 —Russell s traction Balanced traction adaptable to many types of thigh and hip fractures allowing relatively free motion of the patient in bed Countertraction is obtained by elevation of the foot of the bed The overhead trapeze adds greatly to patient s independence

When the adhesive strips have been applied, the hammock is slipped under the knee and a rope is attached to it This rope passes to the overhead pulley and thence to the uppermost of the two pulleys on the crossbar at the foot of the bed It is then passed over the pulley on the foot spreader, and back to the remaining pulley on the end of the bed Weight is then attached Eight or ten pounds are usually ordered for an adult

suspended to these, at right angles from the body When the weights have been applied the nurse must be sure the child's buttocks just clear the bed, and some form of restraint will be necessary to maintain this position—either a specially designed jacket or a Bradford frame with harness restraint to keep the child in position on it

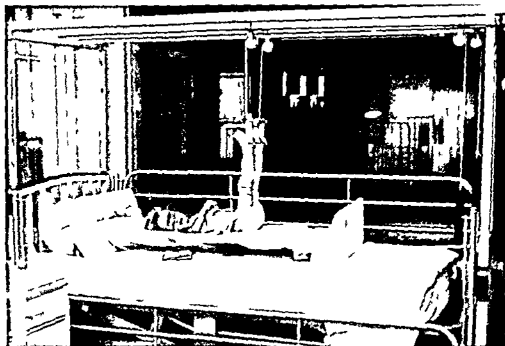


Fig 85 —Bryant traction for use in fracture of the shaft of the femur in young children Frame is used to restrain child

RUSSELL TRACTION

Russell traction is in fairly general use in the treatment of fractures of the femur When it has been properly applied and is in good mechanical working efficiency it will restore muscle balance and make reduction of the fracture easier to maintain Furthermore it is a comfortable device for the patient, and this is not the least of its merits

The equipment required is not elaborate (Fig 86) A single section of the common Balkan frame can be attached to the bed, with the overhead bar directly above the injured limb Four pulleys are used These pulleys are arranged so that one is on the overhead bar at a level directly above the tubercle of the tibia of the fractured leg A second is attached to the footplate or spreader Two pulleys are attached to a crossbar at the foot of the bed placed at about the level of the mattress

thereby representing relative magnitude With these two lines we can, of course, finish the construction of the quadrilateral or parallelogram Now, if the traction is in good mechanical efficiency, a diagonal passed through this parallelogram will pull in the direction of the long axis of the femur This diagonal represents the *resultant* pull—that is, the *combination* of pulls of the suspension and traction, which are unified in the direction of the long axis of the femur

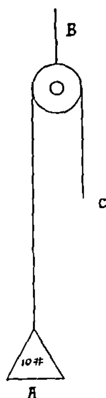


Fig 89 —Sketch to explain principle of weights in Russell traction In order to balance *A* (the 10 pound weight) the person pulling on *C* would have to exert 10 pounds of effort It can easily be seen then that the amount of force being exerted on point *B* would be 20 pounds If the point *B* represents the patient s foot the 20 pound pull on the foot is apparent

Important nursing points are these The angle between the bed and the hip should be approximately 20 degrees The heel of the foot in traction should just clear the bed Firm pillows should support the thigh and calf along their entire length, leaving the heel free of the bed The popliteal space must be watched for ridging and skin denudation Back rest is usually permitted and no difficulties are encountered in giving nursing care, since the fractured leg is not at the mercy of gravity and

We are told that the pull of *traction* is now twice that of *suspension* Remembering Newton s Third Law of Dynamics, ' To every action there is an equal and opposite reaction' and considering the 10 pound weight in the light of an 'action" or effort, this can be readily understood, by studying the diagram (Fig 89) In order to balance A (the 10 pound weight) the person pulling on C would have to exert 10 pounds of effort It can easily be seen then that the amount of force being exerted on point B would be 20 pounds If the point B represents the patient's foot, the 20 pound pull on the foot is apparent

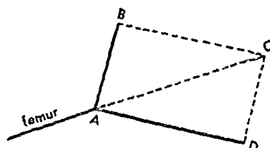


Fig 87

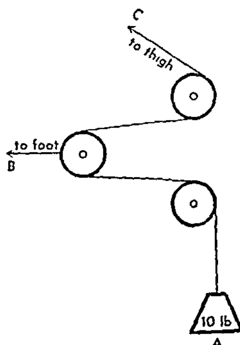


Fig 88

Figs 87 88—*Drawings to illustrate working of Russell traction Imaginary* parallelogram Point *A* is the knee *AB* the rope suspending knee *AD* the line of the adhesive traction on lower leg *AC* is the resultant or sum of the pulls *AB* and *AD* which if the traction is correctly applied should be in direct line with the long axis of the femur (From Russell Traction by Carmelita Calderwood American Journal of Nursing)

The parallelogram of forces acting on the fractured femur about which surgeons speak is of course, an imaginary parallelogram It can be constructed by using the skin traction as one side of a quadrilateral, and the rope suspending the knee as the other Inasmuch as we now know that the suspension is equal to about half of the traction, we make the vertical side of the quadrilateral only half of the horizontal length,

thereby representing relative magnitude With these two lines we can, of course, finish the construction of the quadrilateral or parallelogram Now, if the traction is in good mechanical efficiency, a diagonal passed through this parallelogram will pull in the direction of the long axis of the femur This diagonal represents the *resultant* pull—that is, the *combination* of pulls of the suspension and traction, which are unified in the direction of the long axis of the femur

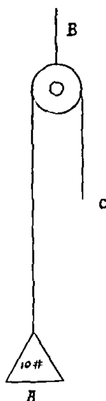


Fig 89—Sketch to explain principle of weights in Russell traction In order to balance *A* (the 10 pound weight) the person pulling on *C* would have to exert 10 pounds of effort It can easily be seen then that the amount of force being exerted on point *B* would be 20 pounds If the point *B* represents the patient's foot the 20 pound pull on the foot is apparent

Important nursing points are these The angle between the bed and the hip should be approximately 20 degrees The heel of the foot in traction should just clear the bed Firm pillows should support the thigh and calf along their entire length, leaving the heel free of the bed The popliteal space must be watched for ridging and skin denudation Back rest is usually permitted, and no difficulties are encountered in giving nursing care, since the fractured leg is not at the mercy of gravity and

will not be altered in position during any type of nursing care Pro vision should be made for prevention of foot drop on both feet

Care of Patient in Russell Traction —Russell traction includes sus pension of the limb in traction, and for that reason nursing care of the patient is much simplified The patient is usually allowed to sit up, to turn and to move at will, because the line of traction is not disturbed by these movements Care of the back, making of the bed, giving of the bedpan are thus much simplified Other nursing features which are important in caring for the patient in Russell traction are as follows

1 To prevent wrinkling of the sling under the popliteal space, a piece of felt may be inserted between the sling and the patient's skin This will assist in eliminating pressure areas which sometimes form at this spot

2 Whatever the position the patient assumes, the angle of flexion of the hip in traction should be as near 20 degrees as possible at all times (This is the angle between the thigh and the bed, not between thigh and abdomen)

3 The heel should clear the bed The ideal position for the heels in Russell traction is that of a person standing with his heels four inches apart Abduction is to be avoided

4 Two pillows are usually used under the traction one of them is under the thigh to maintain the desired angle the second is under the calf down to and including the tendon of Achilles

CARE OF PATIENT IN A THOMAS SPLINT

When a Thomas splint or any type of ring splint or suspension ap paratus is used in conjunction with skin or skeletal traction, the patient is usually allowed more latitude in moving about in bed If the leg rests on the bed as it does in Buck s extension, any movement the pa tient makes with his body will in some degree alter the position of the traction When suspension is used however, the slack occasioned by the patient s movement is taken up at once by the suspension apparatus and the line of traction remains unchanged Suspension allows freedom of the body as a whole while still maintaining efficient traction on the limb

We are told by Dr McCrae Aitken historian for Hugh Owen Thomas who invented the Thomas splint, that Thomas invented the hip splint for a certain Sara McTurk in the year 1867 He had long disliked any type of traction apparatus which rested on the bed, because he noted the sagging of the limb which occurred when a bedpan was placed

beneath the patient The invention of the Thomas splint was an attempt to allow the patient to be moved for the bedpan and other nursing requirements without changing the position of the limb which was in traction

Since the patient may be moved more safely, the problem of the sacral decubitus is not as troublesome as it is in other kinds of traction Furthermore the splint is usually suspended or hung, and pressure on the heel of the leg in traction can easily be avoided There are other nursing problems to consider, however, because of the pressure of the ring into the adductor and ischial area

The ring of the Thomas bed splint is usually covered with a smooth basil leather which is moisture resistant It is usually considered advisable not to pad these rings with cotton or gauze

When the daily bath is given, careful attention will be necessary to the area of skin which is contacted by the ring, and the leather ring itself must also have special care The patient may be turned toward the leg in the splint The skin beneath the ring must be pushed back and forward until all parts of it have been washed, rubbed with alcohol, and powdered This is done by gently pulling the skin from under the splint above and below The whole process contributes greatly to the patient's comfort and helps to preserve the integrity of the skin Care should be taken not to apply the powder either to the skin or the leather ring until they are well dried, as the powder will cake

The ring should be polished with saddle soap each morning and, if necessary, after each time the patient voids A brisk rub is given to the leather and this is followed by a rubbing with a soft dry cloth The leather will take on a high polish that is moisture resistant When the ring is thoroughly dry, it may be powdered sparingly Alcohol should not be used on the leather as it tends to harden it and make it uncomfortable for the skin A soft, pliable, waterproof surface is the goal to be worked for

The tendency for pressure sores to form in the adductor and ischial region can be overcome by elevating the foot of the bed from twelve to eighteen inches The patient will thus pull away from the splint somewhat, and in some cases this may be considered undesirable The surgeon should always be consulted before this is done

A half ring Thomas splint (Fig 77) is frequently used in balance traction The splint is placed with the half ring on the anterior aspect of the thigh With this arrangement the patient does not sit on the ring there is less irritation in the groin area, and the difficulty and dis

comfort in using the bedpan is considerably lessened The ring is not covered with padding and leather, consequently there is not the nursing problem of keeping it dry and clean

Position of Extremity in Balance Traction—The position of the extremity in traction is determined by the doctor, but it is well for the nurse to know that the limb is usually held in a neutral position (toes and kneecap pointing toward the ceiling), or in a position of slight internal rotation The amount of abduction may vary with the patient However, the nurse needs to recognize that when only one leg is in traction, the position the patient assumes may greatly alter the amount of abduction being maintained If the patient lies diagonally in bed, abduction is lost Fig 90 illustrates the use of a sandbag to remind the patient as to the position he should maintain



Fig 90—Balance traction applied following cup arthroplasty Note position of the extremities

The patient s knee should correspond with the fastening of the Pearson attachment to the splint Generally speaking it is desirable to have the Pearson attachment (the part which supports the leg from the knee down) horizontal with the mattress and just high enough to swing clear of the bed The position of the ring should be observed frequently It needs to rest in the groin but should not cause undue pressure or irritation

PELVIC TRACTION

This type of traction may or may not be used in conjunction with a Bradford or Whitman frame The pelvic girdle is customarily made of canvas, darted to fit the shape of the body It is more comfortable if lined with flannel, which may be quilted in several thicknesses This girdle is not to be made to fit the waistline except in its upper border It is a pelvic girdle and is to pull from the bony crests of the ilia, so its lower border will be considerably wider than the upper It should fit snugly over the crests of the ilium and the pelvis, much as a girdle or garter belt does On either side are tape webbing straps, usually two or three, joined together to form one strip at about the level of midthigh This strip should contain a steel ring if possible for securing the rope for traction The girdle is customarily fastened in front with tape webbing straps and buckles

At the foot of the bed two pulleys are necessary, about two feet apart Ropes attached to the girdle extend through these and are attached to weight carriers and weights The amount of weight ordered for each side is usually from 6 to 8 pounds, depending on the patient's age and size, and the reason for applying the traction This number is gradually increased Working up to the maximum weight is more satisfactory than beginning with a large amount It is the prerogative of the surgeon to order the number of weights, but when left to the nurse's judgment, it is better to begin with too little than too much, as discouragement on the part of the patient during the first few hours may make further treatment difficult *Weights are not lessened or removed without the permission of the doctor who has given the order to apply them* Orders may occasionally be given to remove some of the weights at night to enable the patient to rest more comfortably This type of traction may be applied to the scoliotic patient to relieve pain and to gain some correction, or it may be applied to the patient with back pain to relieve muscle spasm

The greatest complaint a patient in traction will have during his first twenty four hours will probably have to do with pain in the lower part of the back, in the lumbar region The thoughtful traction nurse will place beneath this area some type of hard narrow pillow, never one of the feather variety If such a pillow is not available, a sheet folded lengthwise will give considerable relief The patient may remove the pad as necessary for comfort This pain in the low back is due to a spasm of the extensor muscles of the back which occurs in conjunction with the pull upon the flexor muscles of the thigh

Another point of discomfort to the patient newly in traction is a feeling of strain under the knee A very small pad, such as might be made by a folded towel, placed under the head of the tibia, will relax this joint satisfactorily and contribute much to the patient's comfort

HEAD TRACTION

It is preferable that head traction be secured with a well made halter, ordered specifically for the patient who is to use it Orthopedic and surgical supply houses have these available, or they can be custom made



Fig 91 —Sayre chin strap for exerting traction on head

of canvas or leather under prescription by a qualified brace maker Improvised chin halters tend to irritate the chin and neck and often cause so much soreness of the muscles of the mandibular region that the patient is unable to eat A more serious type of complication from home made appliances is that they have been known to slip and cause partial suffocation in small children

Head traction is sometimes used in the home for short daily periods for patients with dorsum rotundum, cervical arthritis, and other conditions requiring hyperextension of the spine If no halter is available

a temporary one can be constructed by using a three by fifty inch strip of soft outing flannel of double thickness This strip is stitched together end to end to make a large loop The loop is fitted into a halter across the patient's chin in front and across the occiput in back, leaving equal lengths of the loop at each side of the head These side loops extend upward on each side of the head to the spreader Each loop will need to be joined above the ear by means of a rubber band or a piece of bandage, and adjustment should be made for the comfort of the patient and for the proper working of the apparatus when the weights are applied A spreader can be made of heavy wire by a local blacksmith It must be emphasized, however, that this type of halter is suitable only for temporary use and for a small amount of attached weight

The spreader used in head traction should be wide enough to prevent pressure on the side of the head by the halter The jaws and ears will become irritated if the spreader is too narrow

NURSING CARE OF THE PATIENT IN HEAD AND PELVIC TRACTION

If a Bradford or Whitman frame is used, it should be as wide as the patient's shoulders from acromion process to acromion process, but no wider, and six inches in addition to the length of the patient s body is considered the optimum length Frame covers of stout canvas are necessary and may be laced or buckled If the patient's weight is con siderable, sagging is likely to occur after he has lain on the frame for several hours, and sandbags may be inserted under the apex of the curve of the Whitman frame When there is considerable deformity of the spine, the contact of the kyphos or hump with the frame may cause discomfort and irritation Constant care of the skin over this area will be necessary Occasionally the section of the frame directly under the kyphos is cut out, or a divided frame cover may be used at this area and some elastic material used to fill in the space between the two sections of the frame cover

The pelvic girdle can be made of canvas, padded slightly and lined with soft outing flannel The chin strap may be either the commonly used Sayre suspension sling, or one of the numerous substitutes which can be made or purchased Too much emphasis cannot be placed on the necessity for conscientious care of the chin during the period of traction Alcohol rubs are almost always permissible, except in cases

of acute inflammation, and should be given at stated intervals during the day Cocoa butter or cold cream massage, followed by alcohol to toughen the skin, provides an excellent skin treatment if it is in good condition at the beginning But under no circumstances should massage or oils be applied in the presence of acne, as inflammation is likely to follow This is especially true in hot weather Soft material such as silk, sheet wadding, or silence cloth, inserted into the chin cup and changed frequently, gives the patient considerable comfort Should the skin condition prohibit the use of the chin itself for traction, occipital traction can be substituted In these cases the back of the head must be inspected closely each day for signs of irritation or pressure The use of frequent shampoos for any type of head traction is indicated, to improve the circulation of the scalp and lessen the danger of decubitus

The girdle must pull on bone, and is, therefore, a *pelvic* girdle, exerting traction on the skeleton by way of the ilia and not an *abdominal* girdle Because it *is* exerting traction on bone, the crests of the ilia must have constant care, and, frequently, in the thin patient, padding over the crests will be necessary Weight in head and pelvic traction is usually increased gradually, and though it may be started with as little as 5 pounds on each side of the pelvis, and 3 on the head, it is usually increased until the patient is supporting a total of from 30 to 50 pounds The hazards of this amount of pull to thinly padded bony prominences are readily understood

Many orthopedists permit patients with mild spinal deformities to lie prone at mealtime supporting themselves on their elbows The tray or dishes may then be placed between the elbows, and the patient allowed to feed himself at least part of the meal Placing the tray at the side of the bed is discouraged as the patient can reach the tray only by twisting movements of the body

At all times during this period of traction, the feet must be given protection Some kind of foot support must be placed at the foot of the bed in such fashion that ropes are not contacted Simple foot exercises carried out during morning and evening care will keep up the tone of the muscles Dorsiflexion combined with toe flexion (*not* toe extension which is the patient s usual tendency while dorsiflexing) is considered an adequate exercise for maintaining tone in muscles to be used for walking When lying prone the patient s feet must be supported or allowed to lie over the edge of the mattress

The patient is allowed considerable freedom while in traction Arms and legs may be used at will provided the trunk is kept in alignment

The patient is not allowed to sit or to turn on his side An exception to this rule might be made in the first forty eight hours when the traction is new to the patient A little freedom at this time often pays good dividends in greater cooperation later on

Doctors usually permit the patient to be out of traction for the daily bath and rub, and frequently the privilege is extended for meals It is, however, a source of great disturbance to the orthopedist to find this privilege being used without sensible limitations

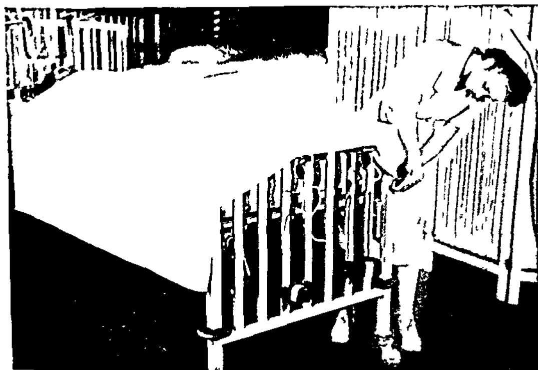


Fig 92—Method of securing spread at foot of bed without disturbing traction

The bath is given on the anterior surface of the body, with special attention to the afore mentioned points The frame is then pulled to one side of the bed, and the nurse goes around the bed and begins to change the under sheet This is brought flush with the frame so that the patient may be turned onto a clean surface If the frame is a straight one (Bradford), the patient may lie flat when turned, with adequate support for the dorsum of the feet If the frame is curved (Whitman), pillows are arranged under chest and thighs to simulate the amount of hyperextension the patient has been accustomed to when lying supine If the patient is small and cooperative, the nurse may turn him alone He is instructed to stiffen himself tensely, and the

nurse grasps shoulders and hips and gently turns him toward her, moving the body as though it were "all of a piece" If he is large, two or three nurses may be needed to accomplish this

The posterior part of the bath is then given, followed by a brisk rub which includes the backs of calves and thighs as well as the back itself The patient may lie prone while the nurse tightens the frame and applies a clean outer cover to it *No amount of hurry should be permitted as an excuse for not tightening the frame daily* The patient s body has made its mark and the frame is hammocklike after twenty four hours

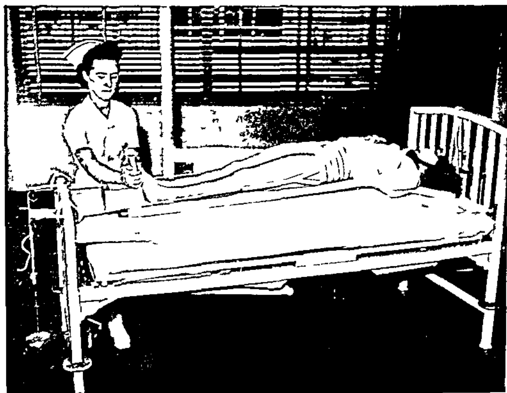


Fig 93—Patient on Whitman frame with pelvic girdle and Sayre chin strap in place Note boards to prevent frame from cutting into mattress Foot support is always necessary but some orthopedists feel that anything more than a pillow for this will disturb efficiency of traction

The frame is moved from the bed, and the under sheet is completed The frame is then returned to the bed, the pelvic girdle is placed in position, and the patient is turned back onto the frame as he was turned off The girdle is fastened low on the pelvis, tight enough to remain secure without being uncomfortable, and the ropes and weights are again attached The upper part of the bed is made in such a fashion

that there is no interference from bedclothes on the ropes "Divided" linen for this type of patient is ideal and more economical

Where cervical fracture or dislocation is present, difficulty may be encountered in giving adequate care to the chin and occiput Traction must of necessity be constant, and, if considerable weight is being used, some danger to the skin over bony prominences may be expected With the permission of the surgeon, the chin strap may sometimes be removed One nurse exerts direct manual traction on the head The grip for this is more comfortable to the patient if the nurse's palms are placed against his cheeks, her fingers flexed under his chin The thumbs are not used during the process, and care should be taken not to encircle the patient's neck with the hands at any time during the process A second nurse bathes and gently massages the skin and subcutaneous tissues of the lower jaw and chin

Care should be taken to provide a spreader for head traction which is wide enough that no unpleasant contact is made by the halter on the patient's ears or jaws The occipital region requires special attention as pressure sores not infrequently develop in that area

NURSING CARE OF PATIENTS IN SKELETAL TRACTION

Various types of surgical apparatus for applying direct traction to bone have been used in the past fifty years Nails, horseshoe clamps, stirrups, and ice tong calipers have been used, but for the most part these have been supplanted by the Steinmann rustless steel pin and the Kirschner piano wire of chromic steel The latter is perhaps the most commonly used type of skeletal traction and is preferred to the Steinmann pin because it is smaller in diameter and the disturbance to the bone occasioned by its use is almost negligible Skeletal traction may be applied to the lower extremity through the proximal or distal end of the tibia, through the heel, and through the distal end of the femur It may also be used in the upper extremity and in the skull

The wire or pin may be inserted in the operating room or, if necessary, on the ward The anesthetic used may be general or local It is a surgical procedure and requires the most scrupulous aseptic technique in its performance Usually the area where the pin will be inserted is prepared surgically in advance of the procedure

The wounds made by the introduction of the wire may be dressed with sterile gauze sponges secured by adhesive, or small, quartersize cir

cular sponges may be used, sealed with collodion Whatever the type of dressing preferred by the doctor, the important thing is that it is not disturbed after it is applied unless evidences of gross infection become evident Daily inspection of the wound is not necessary, and infections have been traced to overzealous dressing and cleansing of these wounds Care should be taken not to allow the dressings to become contaminated by the patient's hands or through accidental spilling of fluids on the dressings

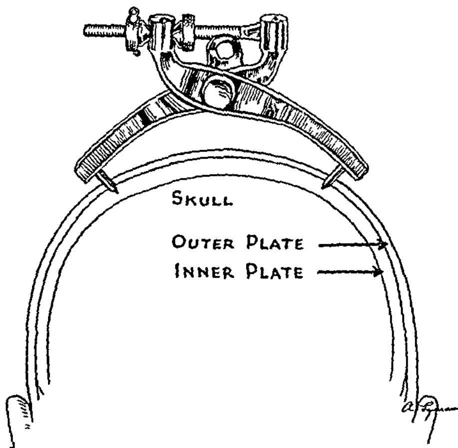


Fig 94 –Crutchfield tongs apparatus

It is usually wise to have a Thomas splint and Pearson attachment prepared and sent to the operating room with the patient If the wire or pin is to be inserted on the ward, the splint should be ready to be put on the patient s leg before the skin area is surgically cleansed

Equipment to attach the weight to the U shaped clamp which will be attached to the nail or wire should be ready on the ward when the patient returns from the operating room if the procedure is carried out

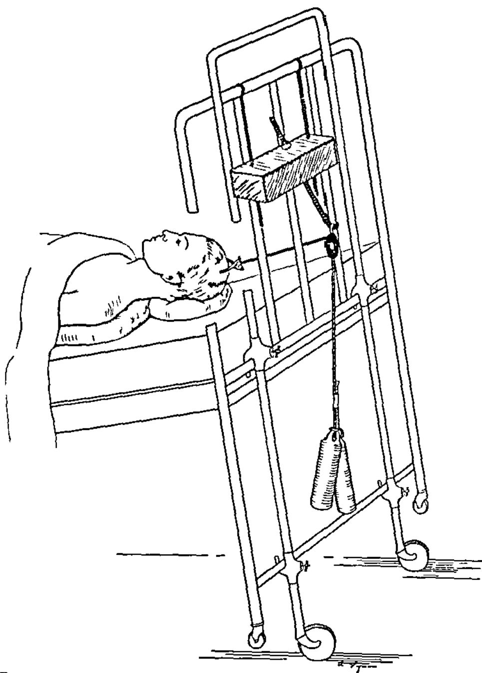


Fig 95 —Crutchfield tongs Head should be low shoulders high The upper end of the bed should be elevated Traction weights of from 25 to 35 pounds may be applied safely and comfortably

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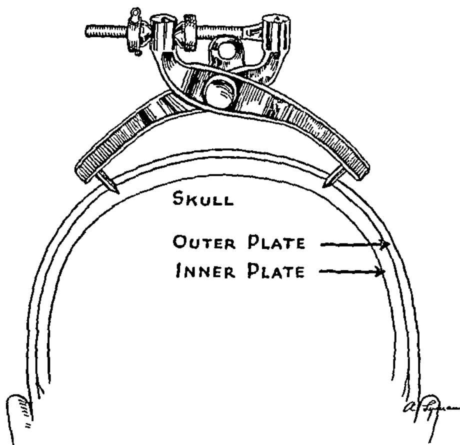


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horizontal with the mattress Buck's extension is sometimes applied to the leg below the knee Equipment for preventing foot drops consists of an adhesive strip fastened along the sole and attached by rope to an over head pulley (Care must be taken not to exert pressure on the toes as contracture of the toe extensors will be likely to occur)

Ropes are now attached to the U shaped traction clamp which holds the pin This rope passes to a pulley at the end of the bed, where the weights are attached The pull is thus in line with the Thomas splint and with the long axis of the femur

The patient is allowed to move about rather freely in bed He may sit up in bed or he may turn to his side as much as the traction will permit The nurse must handle the apparatus with gentleness, however, for jarring movements are particularly dreaded by the patient The rules applying to efficient skin traction also apply in skeletal traction, and nurses should be alert in their observations to see that the apparatus is mechanically correct and in good working order at all times

When the wire or pin is to be removed, the skin is prepared as care fully as it was for the original procedure Sometimes the surgeon will ask that the area surrounding the wire be saturated with alcohol solution for twenty four hours before the removal

The traction clamp and weights are removed from the limb, and the wire end on the outer aspect of the leg is sterilized with iodine, alcohol, and ether The skin is then pushed inward and the wire cut off be neath the surface of the skin The wire is pulled through from the op posite side Small sterile dressings are applied to the pin areas until heal ing takes place

BATHING TRACTION PATIENTS

Traction patients, like most other orthopedic patients, are bathed over the anterior surface of the body as the first step of their morning care An under blanket is seldom used, as it requires too much manipu lation of the patient During the bath the toes are carefully cleaned and the sole of the foot is massaged with alcohol or oil This is the time to inspect the area around the traction tapes or bandage Particular at tention is given to the back of the heel and the tendon of Achilles, which so often become sore where adhesive and bandage have been applied too snugly The dorsum of the foot is inspected for signs of "ridging" or cyanosis If the protective bandage over the adhesive straps has become loosened either at the ankle or groin, it should be re enforced or reap plied

there Much discomfort can be eliminated if the weights are attached before the patient becomes conscious or before the local anesthetic has completely worn off

Corks are usually applied over the sharp ends of the wire or pin to protect the nurses and patient from injury All handling of the U clamp, the rope, and the attached weights must be exceedingly careful to avoid causing pain and discomfort to the patient

Skeletal traction is frequently used in fractures of the lower third of the femur, where it is essential that the fracture be treated with the knee in flexion The Thomas splint with a Pearson attachment is generally used with this type of fracture The splint and attachment are prepared with wide muslin strips or slings to support the thigh and lower leg

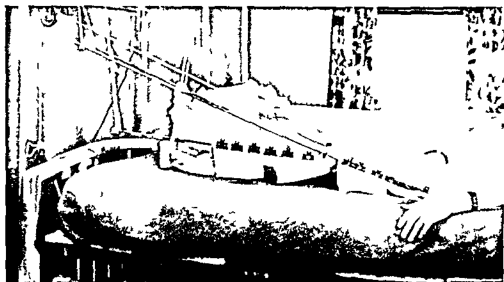


Fig 96 —Skeletal traction applied to the distal end of the femur The limb is supported by means of a half ring Thomas splint with Pearson attachment The clips placed on the lateral aspect of the splint hold the canvas strips taut The limb is in a neutral position and from the knee down is supported by the Pearson attachment The position of the foot support can be adjusted to the patient s needs

These strips should be fastened securely with manuscript clips or with large safety pins on the lateral aspect of the splint to make tightening them more convenient An overhead frame with pulleys is necessary for suspending the Thomas splint The Thomas splint will usually be ele vated at an angle of 45 degrees with the bed The Pearson attachment is attached to the Thomas splint at the knee joint The knee is flexed to 45 degrees, and the lower leg lies in the Pearson attachment which is

Without explicit permission weights are never removed at any time during the nursing care given these patients This is an axiom of such serious import that it can scarcely be emphasized too strongly The damage that can be done in fractures of the extremity by this kind of thoughtlessness may on some occasions be almost immeasurable This is equally true of tuberculous and septic joints

When the patient has been bathed on the anterior surface of his body, the under sheet should be changed from the unaffected side If the patient is a child, one nurse will be enough to assist with back care If the patient is heavy, it should preferably not be done without two assistants Both assistants stand on the opposite side of the bed from the nurse who is bathing the patient One assistant supports the entire limb in traction, maintaining good alignment The other places one hand across the patient's buttocks and the other under the shoulder girdle For this procedure, the nurse or attendant must use good body mechanics to protect herself against strain and fatigue she should flex hips and knees sufficiently so that she may keep her back straight, she should stand in the foot forward position, she should be as close to the bed and the patient as possible, and she should tense her corset muscles for the activity *before* she begins to lift

In washing the patient's back, close attention should be paid to the sacral area This is a very vulnerable spot and must have constant care or the skin will be likely to break down It should be emphasized that nurses giving care to such patients should take the trouble to inspect this area by looking at it The fact that the area is below the eye level often makes the nurse content to wash and rub the part without sufficient inspection Sensitive as one's fingers are, they will miss change of color—the purplish redness of the skin in the early stages of pressure before the skin breakdown has occurred This is the time when further damage may be prevented, and it is important to detect the oncoming trouble before it progresses further If signs of pressure are present, the area should be massaged gently and covered with a thin coating of talcum A rubber ring may be provided, or squares of sponge rubber may be used If available, squares of unclipped sheepskin may be placed under the sacral area Most important of all, in the case of the patient who cannot be turned, is frequent massaging of the part This can be done, of course, without raising the patient each time The nurse may slip her hand under the area and give an acceptable massage several times a day without changing the patient's position Even moving the skin back and

Nurses caring for patients in traction should make the observations listed below each time they give nursing care Traction to be effective requires constant vigilance, and nurses working on orthopedic wards should train themselves to take in many details of the apparatus at a glance

1 Is the circulation in the extremity adequate? (Pallor, cyanosis, coldness, or swelling should be reported)

2 Is the condition of the skin around the tape satisfactory? (Look particularly for signs of irritation, pimples, purulent discharge Use nose as well as eyes for the latter)

3 Is the patient comfortable and warm? (Traction should never be a source of undue discomfort for the patient)

4 Is the patient s bed position good, or does he use faulty body mechanics to thwart the purpose of the traction? Is the foot in traction protected against foot drop? Is provision made for maintaining the limb in a neutral position, and the prevention of external rotation? Is there any inversion or eversion of the foot in traction? Is the opposite extremity in good alignment and protected against the pressure of the bedclothes? (It is particularly important to observe any tendency to lie with the foot in an inverted position If this happens, the padding over the area around the head of the fibula should be inspected If this padding has slipped it may mean that pressure is being exerted on the peroneal nerve which lies close to the surface in this area The peroneal nerve innervates the evertors of the foot and injury to it may cause a partial or complete paralysis of the evertor muscles, making it impossible for the patient to turn his foot outward)

5 Is the tape slipping at any point? Are the covering bandages adequate and secure?

6 Is the pulley working mechanically? (Watch for a stiff, unmoving pulley or a pulley with a shallow groove, which allows the rope to slip off easily)

7 Does the footplate or spreader contact the end of the bed when the patient slips down in bed somewhat?

8 Are the weights at a good level above the floor and also a considerable distance below the pulley? Are the knots secure?

9 Is countertraction provided?

10 Is there any impingement on the ropes either from the bedclothes or other apparatus? (Ropes should contact nothing but the pulley)

11 Does the bed sag under the patient's buttocks? Are the heels digging into the mattress?

in the bed. Trauma can occur to the skin from wrinkles in the under sheet, the rubber sheet, or the drawsheet; it can occur from grit in talcum powder. A wet bed is a well recognized cause of skin abrasion, and the necessity for keeping the bed dry and smooth can scarcely be overemphasized. Patients who lift themselves on their elbows many times during the day may develop pressure sores at these areas. Another vulnerable site is the heel of the unaffected foot because of the tendency the patient has to push himself up in bed with this foot.

Pressure areas go through certain rather well defined stages. The first stage of redness will usually be accompanied by the patient's complaint of a hot burning pain at the site involved. After a day or so the initial reddened area may cause the patient little pain because of the paralysis of the sensory nerve endings in the skin. The redness in the area may take on a purplish cast which will not disappear upon blanching. The skin may break, due to an almost undetectable vesicle formation. Unless this is checked, ulceration may follow and the denuded area may become infected and septic. Tissue necrosis may cause deep craterlike holes in the skin and underlying soft tissues which may reach down to the bone.

Fundamental to all treatment for this condition is removal of pressure. Frequently permission may be given to turn the patient to his side for short periods to relieve pressure on the sacral area. If this is done, the nurse should be careful to keep the legs in good alignment. The top one should be supported with pillows to prevent sagging. A brisk rubbing to restore circulation to the threatened area can be given, but it should not be vigorous enough to endanger the skin. Alcohol and alum may be used to toughen the skin, but it is advisable to use oil on the area once during the week to prevent excessive drying of the skin. Sponge rubber squares or squares of unclipped sheepskin are often effective in preventing the progress of pressure areas if used during the early stages. Calamine varnish may be used to cover threatened areas. It is applied with a brush and allowed to dry thoroughly before coming in contact with the sheet. The use of photographer's rubber cement to cover the calamine has been reported favorably by some nurses. This forms a waterproof protection which is also an astringent.

Some physicians prescribe drying powders such as boric or zinc. Tincture of benzoin is sometimes of benefit in the early stages of denudation. Other methods which have been used with good results are a spray of 10 per cent tannic acid solution and 1 per cent salicylic acid. When this has dried, the surface is coated with a 10 per cent solution of silver

forth for a short period may prevent undue pressure on any point for a dangerous period and will be valuable

The under sheet and drawsheet are usually changed from the side which is not in traction If the patient is a child, it is sometimes more convenient to change bed linen from the bottom or from the top of the bed Many variations of bedmaking and bath giving procedures are necessary in caring for the traction patient, and no one way can ever be set down dogmatically as the best for all patients

An overhead bar, or trapeze, is almost indispensable for the adult traction patient With this device he can support himself for back care and thus spare the nurse much unnecessary lifting However, in cases of fracture or septic and tuberculous joints, a second nurse or attendant should be on hand to steady the limb and keep it in proper alignment during the time the patient is receiving back care

PREVENTION AND TREATMENT OF PRESSURE SORES

The problem of preventing pressure sores on patients in traction is a very serious matter Traction seems to predispose patients to this condition, first, because in many instances alteration of position is not allowed, and, second, because a great number of traction patients are elderly It is very common for the older person in traction to have continual back elevation of from 30 to 45 degrees as a safeguard against pulmonary congestion This, of course, places a considerable portion of the body weight on the sacral area, and pressure sores tend to occur at that point with great frequency In addition, the elderly patient often has a dry tender skin, and the protective fat pads are gone from over bony surfaces Often their nutrition is inadequate, particularly as regards protein and vitamin C, both of which are exceedingly important elements for promoting tissue health

It is important that nurses recognize these hazards before trouble begins to occur They should consult with the doctor in regard to proper diet and obtain his assistance and advice in meeting the problem He will often be able to help them in planning for change of position Usually some latitude will be allowed in the case of the elderly patient who must be in traction over a considerable period

But a great deal of the problem of prevention is the responsibility of the nurse She must recognize that trauma of any nature which endangers tissue integrity is a great factor in the production of skin abrasion, and the trauma need be no more than that caused by a few crumbs

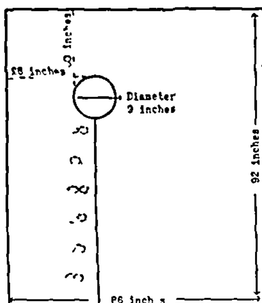


Fig 97—Diagram of fracture or traction sheet (From Some Fracture Nursing Problems by Delphine Wilde Courtesy the American Journal of Nursing)

Fig 98—Traction sheet A small blanket may be used to keep the extremity warm

nitrate These coatings form a thin protective crust over the threatened area and may prevent progress of skin breakdown

Treatment for the advanced pressure sore with its craterlike hole is a more difficult problem Packs of gauze impregnated with penicillin ointment, sterile cod liver oil packs, or balsam of Peru are commonly used Daily irrigation with sterile salt solution, Dakin's solution, or solutions containing penicillin or one of the sulfa drugs may be used Sunlight or treatment by bactericidal lamp has been helpful in many cases

Pastes composed of a number of different substances, such as benzoic acid, glycerin, tragacanth combined with Ringer s solution may sometimes be placed in the ulcer They may then be covered with Pliofilm and secured with a very small amount of adhesive Nurses should always recognize the fact that adhesive itself may be a frequent cause of skin breakdown and should use it sparingly

Rubber rings when used under the patient's buttocks should not be fully inflated The heat generated by the body resting on rubber is a discouraging factor, but can be somewhat obviated if the pad has a canvas or flannel cover under the linen casing on which the patient lies

Small pressure pads placed around such points as the heel and the malleoli should not be circular but semilunar in shape Too often the circular pad with its doughnutlike hole cuts off what little circulation is left to the part A half moon which only partially closes the area accomplishes relief from pressure without the accompanying circulatory loss Sponge rubber, cut into varying sizes and shapes, makes excellent pressure pads for heels elbows and other bony prominences

BEDMAKING

In making the top of the bed the efficiency of the traction and the warmth of the patient are the important considerations Appearance of the bed is always secondary If divided linen is available, the making of the bed is a relatively simple matter This linen may be made from standard sheets in any hospital linen room A sheet measuring eighty by ninety five inches may be slit twenty seven inches from the left side up to a distance of forty nine inches These raw edges may be neatly bound or hemmed, cotton tape ties attached at two inch intervals, and this will provide a very simple traction sheet for a single leg the left A more comfortably fitting sheet may have a hole eight inches in diameter at the forty nine inch level This hole in the linen will fit neatly around

the effort Bending knees and hips and contracting the muscles of buttocks and abdomen will enable the nurse to assist the patient more satisfactorily, and with less danger to her own back

PHYSICAL AND DIVERSIONAL THERAPY

It is always important that the parts of the body not in traction be kept in as good condition as possible No unnecessary stiffness or atrophy should be allowed to occur because of the immobilization of the injured part Frequently exercises for the uninvolved portions of the body are ordered by the physician and may include flexion and extension of the hip and knee of the good leg, dorsiflexion and inversion of the ankle, static exercises to strengthen the quadriceps, the gluteals, and the abdominal muscles, exercises to develop the extensors of the elbows and wrists to facilitate future crutch walking, and breathing exercises The patient with only lower extremity involvement is also encouraged to use his upper arms and shoulders freely, particularly in positions of outward rotation and abduction Activities such as combing the hair, fastening the gown at the back of the neck, or lying with the arms out at the sides with elbows flexed and palms upward are beneficial and prevent shoulder restriction which often comes about from long bed rest Equipment must, of course, be supplied to encourage the patient to lie in good physiologic positions a footboard or box, rolls for under the knee, and a firm pad for under the lumbar region, this last is indispensable for the comfort of the patient who has traction applied with the legs in full extension

It is also extremely important that the patient be given something to do A traction patient is confined so closely to his bed for such long periods that restlessness and depression tend to occur rather easily If an occupational therapist is available, she will be able to suggest many crafts suitable for this type of patient Otherwise, the nurse should see to it that some type of activity attractive to the patient is provided, so that he will have the satisfaction of creating something with his hands while he is bedfast Wherever possible, schooling should not be interrupted

Patients in traction may be moved without too much difficulty to courts or porches to provide variation in their daily program If swinging weights are attached to the bed, moving should not be done by one person, for someone should be responsible for holding the weights during the moving process so that they do not swing or become dislodged from

the patient's thigh For a bilateral traction patient, a double split should be made at the proper distance Blankets may be made in the same fashion, and another divided sheet will serve nicely for a bed covering If spreads are desired, the tape ties may be neatly covered by securing them beneath the spread at a distance of four inches from the divided section on one side, and at the edge of the divided section on the other This four inch flap will then serve as a cover for the ties, and a very neat bed is then possible for these traction patients Large flannel socks may be slipped over toes to keep them warm in cold weather, and cradles can be used to suspend blankets if necessary If a small watt electric bulb is used, the patient's warmth need not be so much a matter of concern to nurses during the winter nights, but care must be taken to protect the bulb in some kind of wire cage Where divided linen is not available there are several quite satisfactory ways of making the traction bed A sheet may be prepared by folding it in half with a small blanket in between This may be used for the upper unit of the patient's bed, covering his chest and abdomen The lower part may be made with a similar sheet and blanket, passing over the normal leg and under the leg in traction, which may be protected by a flannel sock and a small light weight woolen blanket *The nurse's well worn ingenuity comes into play* here each time she cares for such a patient, and no set rule can be laid down except that the comfort of the patient and the efficiency of the traction come before the appearance of the bed in orthopedics Under sheets and drawsheets must be snug and tight, but the upper part of the bed may be made as fits the individual case

TRACTION AND BEDPANS

Since a great majority of traction patients lie in a bed which has the foot elevated for countertraction, some difficulty in the use of the bedpan may be encountered There are on the market certain small, tapering pans which can be slipped under the patient without disturbing the traction or altering the position of the hips These fit snugly up against the flesh of the buttocks and prevent backward seepage Female urinals are convenient and eliminate lifting However, for enemas, when it is necessary to use a large pan, a rubber covered pillow placed lengthwise along the back will prevent fluid from running backward into the bed Where there is no trapeze with which the patient can help himself onto the pan, nurses are cautioned to protect their own backs carefully for

Chapter 5

CRUTCH WALKING

The orthopedic patient usually has a great deal of time to anticipate the moment when he will be able to be up on crutches It is a sort of goal which he sets for himself and he looks forward to it with great eagerness because then once again he will be able to get around and do things for himself This is the feature that usually appeals most to him Sometimes this same eager patient has a considerable letdown when he begins to use those crutches He is weak, progress is slow, and many limitations he was not aware of before become apparent

The nurse needs patience and foresight in her management of this situation Many institutions have physical therapy departments to take charge of crutch walking, this is ideal for the patient He receives careful instruction and guidance from a physical therapist skilled in this procedure But in the smaller hospitals no such assistance is available to the nurse and she must take full charge of this part of her patient's treatment

Measuring for Crutches

The nurse must first of all know something about crutches The most common and satisfactory way of measuring a patient for a crutch the correct length is to have him in a back lying position, arms straight at the side (When the patient lies with arms elevated over the head, measurement is often inadequate—contracture of the muscles in the axilla is essential for correct measurement) The tape measure extends from the axilla to a point six to eight inches out from the patient's heel (he should be measured in such shoes as he is to wear in learning to walk) When it is inconvenient to have the patient lying down, measurements can be made by subtracting 16 inches from the patient's total height

Crutches which are more than two or three inches too long should not be cut off to fit the patient without some provision being made for altering the hand bar, which will otherwise be too low The hand bar should be so placed as to allow practically complete extension of the elbow The wrists are to be held in hyperextension, the weight is on the palms

the pulley Shock blocks will have to be removed and replaced during this moving For this reason, if available, Hi Low beds or pins for elevating the foot of the bed are much to be preferred These beds can be moved safely without being lowered

There is on the market at present a new type of self contained traction, which dispenses with pulleys, weights, and ropes With this type moving of beds is much simplified, and other nursing procedures may be carried out with much less interference to traction efficiency

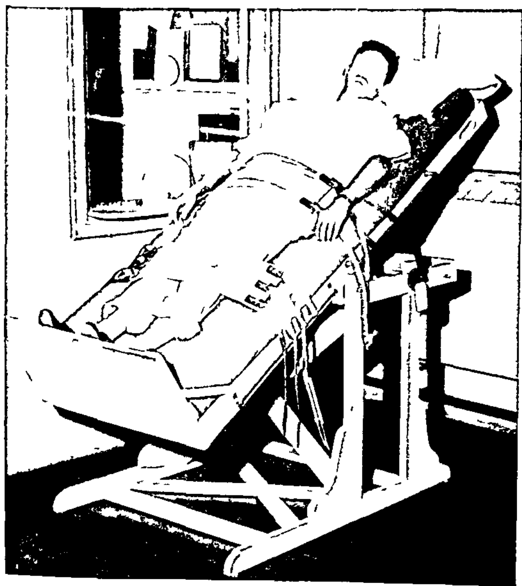


Fig 99 —The tilt table is used to help the patient adjust to the standing position Several times daily he is placed on the table and gradually the vertical position is attained This activity has psychological as well as physiological values

Crutch tips should be of good quality and should be inspected from time to time for wear. A worn crutch tip is a menace, and must be recognized as such, for slipping is likely to result. Slipping may be bad for a normal person, but for the handicapped it may spell disaster.

Padding over the axillary bar is not necessary but frequently is done because the patient thinks it more comfortable. Some authorities believe that such pads encourage the patient to lean on crutches, thus bearing too much weight on this part. Since crutch paralysis is not an infrequent complication from too much pressure on the axilla, under which the radial nerve lies, it is well to discourage this attitude from the start.

Exercises Preparatory for Crutch Walking

In hospitals or clinics where intensive treatment of disabled persons is carried out, attention is first directed toward developing and strengthening the muscles of the shoulders, chest, arms, and back. The patient is made to recognize the fact that he must have strong upper extremities and back muscles to support his weight when he becomes ambulatory. It is important that these things be accomplished before he begins to walk. An overhead trapeze is extremely valuable in encouraging the patient to use his arms and shoulders in lifting his weight from the bed. He should begin standing exercises as soon as his general condition permits him to do so. Prolonged lying in bed can lead only to loss of muscle tone and incipient deformities which will make standing and walking all the more difficult when they are finally undertaken.

During the time the patient is carrying out active and active resistive exercises to strengthen the upper extremities, the weak legs are carried through the full range of joint motion several times during the day to prevent muscle contractures and to minimize joint stiffness.

In getting the patient ready to use crutches, prone lying push up exercises are useful in strengthening the triceps, as are push up sitting exercises performed in the supine position. Sawed off crutches which may be used in a sitting position in bed will help the patient to become accustomed to the sensation of having crutches under the arm and will also give him the feeling of bearing his body weight on his hands. He can be taught how to hold his shoulder girdle as he practices with these sawed off crutches, so that he will avoid hunching and will keep the shoulders at a normal or slightly depressed level. He can learn how to

shift his weight on the crutches while he is still sitting in bed These sideways shifts will do a great deal to enable the patient to transfer himself to the wheel chair when he is ready for that experience Exercises may also include the use of weights With this exercise the finger flexors, the wrist dorsiflexors, and the triceps are strengthened



Fig 101 —Short crutches may be used in preparation for crutch walking Using the crutches to lift the body weight off the bed or mat is valuable in strengthening the shoulder depressors, elbow extensors wrist dorsiflexors and finger flexors

Good Crutch Walking Posture

The standing position is not attempted until the patient has mastered the bed exercises and learned to transfer himself without help into a stabilized wheel chair Standing with crutches may take a long period to master, as it is vitally important that the patient learn to balance himself on the crutches before he undertakes any further activity Two hospital beds, placed with foot ends together and stabilized with wooden blocks, may be used as parallel bars for exercises in balancing, standing and walking

Although nurses will not usually be required to teach crutch walking to the severely handicapped patient, they must know what constitutes safe and efficient crutch walking for this type of patient if they are to supervise such activities on the wards or in the home They should be able to recognize what is the patient's maximum degree of good crutch walking posture and to encourage it at all times The desirable stance is one in which the head is held straight and high, with the pelvis over

A



B

Fig 100 *A* and *B*—Prior to crutch walking push up exercises are done This activity is of special value in strengthening the triceps muscle (elbow extensor)

severe muscular involvement Since they have little muscle power in the front of the body to support them if the pelvis is held too far behind the feet, they must depend on anterior hip joint ligaments to stop them from going too far forward



Fig 103 —Balancing in the tripod position

The patient must, of course, always be assured of his own safety Usually one attendant will stand behind him, and one in front, but care is taken not to touch the patient unless it is absolutely necessary for his safety

Attention to details of good posture is essential when the patient begins to walk If he starts badly, he is likely to continue in the same

the feet, if that is possible with the muscular power the patient possesses The crutches are placed about four inches in front and about four inches at the sides, which makes a large standing base As in all crutch walking, the patient should extend his elbows and carry his weight largely on his hands Care should be taken to see that he does not hunch his shoulders, and very little weight should be taken by the axilla at any time However, the crutches will lean somewhat against the rib cage and are grasped there by the adductor muscles of the arm and chest



Fig 102—Parallel bars are used for exercises in balancing standing and walking They provide added security and safety for the disabled individual

If involvement is such that this position is impossible, that is, when the patient has little or no use of the hip joint muscles, the back or abdomen he is usually taught to balance himself in the tripod position In this position the weight is forward from the ankles with the hips forward and the crutches ahead and out at each side It is important to keep the pelvis as far in advance as possible with patients who have

of security The tripod position is the starting position—a tripod formed by the patient's body and the two crutches The patient stands with his feet slightly apart, and the crutches are placed forward and out from the body in such fashion that a line drawn between them would form the base of a triangle whose apex would be the patient's feet All the factors of good standing posture must be observed In teaching crutch walking, our aim is ultimately to enable the patient to walk without the



Fig 105 —Aluminum forearm crutch (Canadian type)

crutches Faulty unnatural habits developed during this period will inhibit ultimate return to a normal gait Hips will tend to sag backward, chin will be low on the chest, eyes on the floor These defects should be corrected before the patient actually starts to walk

The patient is taught to extend and stiffen his elbow and to place the weight of his body on the wrists and the palms He is taught to avoid bearing any weight at the axillary level, since the radial nerve passes under

attitude Rounded shoulders, stooping back, slumping, flexion at knees or hips, outward rotation of hips, and eversion of the feet are attitudes particularly common to the crutch walker Fatigue, overdetermination to make progress, muscular weakness from long bed rest, may account for some of this Discouragement also may play its part If the patient is allowed to see herself in a mirror, there is sometimes amazing automatic improvement in posture

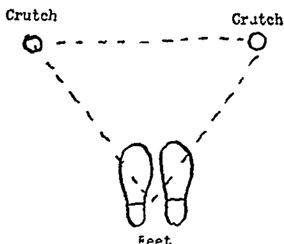
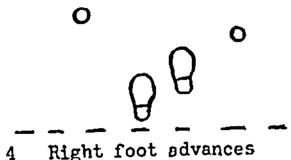
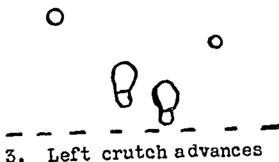


Fig 104 —Diagram showing proper standing position with crutches The two crutches and feet make a triangle (From Crutch Walking" by Doris Nelson Courtesy the American Journal of Nursing)

Sitting with back and feet well supported either on the bed or in a chair should precede actual walking by several days for the patient who has been bedfast for a long time This is followed by standing at the side of the bed in good position, hips and knees extended, back straight, chest forward, and head up Contracting the abdominal and gluteal muscles to provide the 'internal corset will assist with later easy natural locomotion and good posture As the patient stands at the bedside he can be helped in shifting weight from one foot to the other, provided his disability permits, without slumping Alternate knee flexion and extension, and deep breathing exercises may be used to prepare the patient for walking This is the slow approach and the patient may be impatient to start actual locomotion The situation and reasons for the delay must be carefully pointed out to him Getting a patient out of bed and allowing him to walk on crutches in the space of one day usually ends in tears and discouragement

The patient should learn from the first day the proper way of balancing on crutches, as a safety measure and as one for giving him a feeling







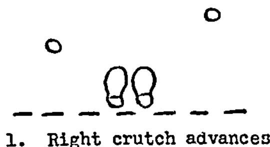


Fig 106 —Diagram showing the four motions of a four count gait (From Crutch Walking' by Doris Nelson Courtesy the American Journal of Nursing)

this area superficially and pressure upon it may cause paralysis of the extensor muscles of the hand and arm It is, however, usually considered permissible to allow the patient with considerable arm and trunk involvement to lean on the axillary bar for brief periods in order to rest the hands The patient should be aware of the danger of using this position too frequently

Beginning crutch walkers have a tendency to try to lift a crutch while bearing weight upon it Nurses should be alert to this tendency and explain to the patient the fallacy of attempting to do this The habit of taking a longer step with the weaker leg, too, is a common mistake made by beginners Patients should be instructed to attempt to take rather short steps of equal length with both legs

The Canadian type of crutch, without axillary rest, is preferred in some clinics—the advantage in the use of these crutches being that there is more tendency on the part of the patient to make better anatomical use of hips and pelvis in locomotion In other words, the patient tends to depend on himself and his own muscles more than on the crutches, which are really not much more than canes The absence of the axillary bar is considered to be advantageous also in that the likelihood of crutch paralysis is much decreased

These crutches are particularly useful for the patient who is likely to need them only for a short period but they do not give as adequate support as the longer crutch with the axillary bar It is usually considered advisable to use the standard type of crutch for patients who have involvement in the trunk hips, and arms In fitting the patient with the Canadian type crutch the handbar should be in such a position that the shoulder girdle can be relaxed comfortably while the hand is dorsiflexed on the bar with the elbow in almost complete extension

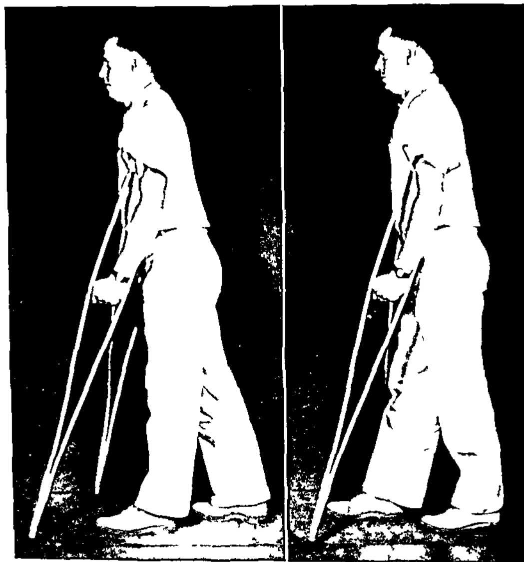
Types of Crutch Walking and Their Use

The type of disability which the patient has determines the type of crutch walking he should do Where help is available through a hospital physical therapist, it should be solicited in making the choice In general, the following will apply to the most common types of orthopedic patients

1 When the patient may do partial weight bearing on each limb, teach the four point or two point crutch gait This is applicable to patients with poliomyelitis arthritis cerebral palsy, etc

2 When the patient must bear little or no weight on one extremity teach the method of advancing both crutches and the affected limb at the same time, three point crutch gait

for poliomyelitis patients, it may frequently have to be used where speed in walking is essential Also, the use of one crutch or cane is an advanced procedure for the method described under 2 The crutch is used on the *good* side, since it is put forward at the same time as the disabled limb, thereby taking the weight off that foot



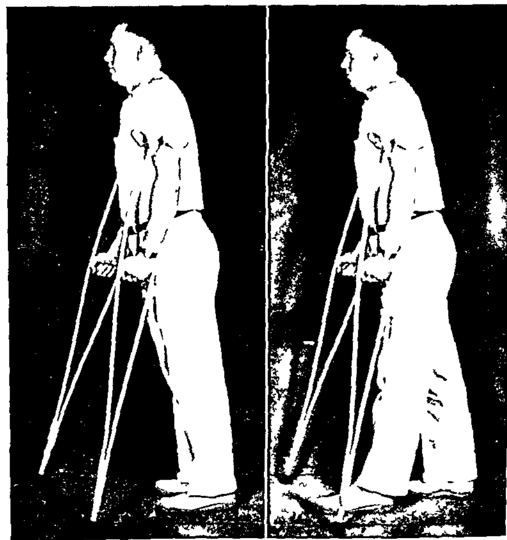
3 4

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Four Point Crutch Gait —The four point gait can be done to a count of 1 2 3-4 The patient puts one crutch forward, then the opposite foot, the other crutch, the opposite foot This is hard for a normal

3 Swinging through crutches is sometimes permissible where paralysis of hips and legs is complete This is the type so frequently seen on the street It does not simulate normal walking in any way and leads to atrophy of legs and hips

Modifications are recognized to be essential For instance, although swinging between crutches is not recommended as a permanent practice



1 *2*

Fig 107—Four point crutch walking *1* Right crutch *2* Left foot *3* Left crutch *4* Right foot *2* and *4* of this group also illustrate the two point crutch walking gait Opposite foot and crutch are advanced simultaneously Right crutch and left foot are advanced together followed by the left crutch and right foot With the four point and two point crutch walking gaits weight is taken on each extremity It is frequently used with the poliomyelitis arthritis or cerebral palsy patient

Three Point Crutch Gait—Crutch walking is usually an ordeal for the patient who has been inactive over a period of time Everything possible should be done to make the experience safe and comfortable



3

(For legend see opposite page)

The patient will need instruction and constant encouragement if he is to learn to use crutches without undue fatigue When no weight bearing has been ordered, or when partial weight bearing is permitted on the affected extremity, the three point gait is usually considered preferable The patient may be taught the mechanics of this gait before he is out of bed, by means of a diagram The affected limb and both crutches

person to do, though it approximates normal walking motions of arms and legs However, with a little practice the patient becomes automatic in the use of it

Two Point Crutch Gait is the same as the four point gait, except faster With this gait, the patient advances the opposite crutch and limb simultaneously—left crutch and right limb, right crutch and left limb



1 *2*

Fig 108—Three point crutch walking gait is used when there is involvement of one extremity It may be used when no weight bearing has been ordered or when partial weight bearing is permitted The affected extremity advances with the crutches and the patient s weight is taken on the hands as the good extremity comes forward

The single crutch should be used on the good side since its purpose is to take the weight of the body when the good leg is advancing forward

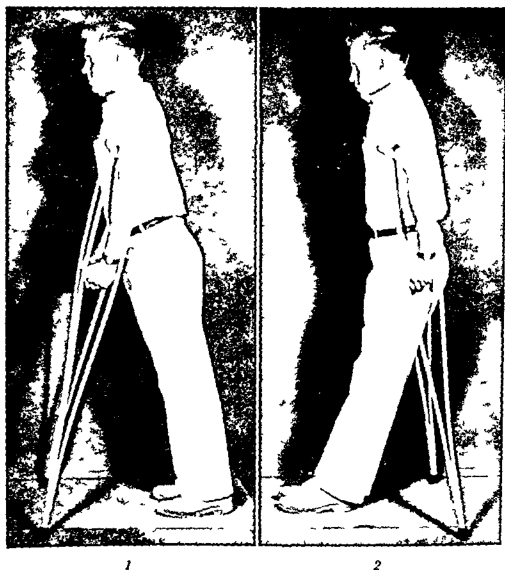
Swing Through Crutch Gait The swing through gait is frequently used by the poliomyelitis patient with paralyzed lower extremities The



Fig 110 —Downstairs with crutches The crutch walker who is accustomed to the three point gait will place his crutches on the lower step take his weight on his hands and bring the good extremity down to the lower step with the crutches Then with the body weight on the good extremity the crutches are placed on the next step and the procedure is repeated

Fig 111 —Upstairs with crutches When going up steps the body weight is taken on the hands and crutches and the good extremity is advanced to the upper step The body weight is then taken on the good extremity and the crutches and involved limb follow A safe rule to remember when teaching the three point crutch gait is that the involved limb always goes with the crutches

are advanced at the same time, then, with the body weight balanced on the two crutches and the weak leg, the sound leg is advanced Care should be taken to instruct the patient to take steps of equal length otherwise he will tend to take a long step while using the crutches and a very short one while advancing the sound extremity



1 2

Fig 109 —The swing through crutch gait is used when both lower extremities are paralyzed The limbs are braced and swung forward together

When the physician wishes the patient to begin weight bearing on the affected leg, this should be begun gradually As the patient advances in ability to manipulate himself on crutches, one crutch may be discarded

Chapter 6

NURSING CARE OF THE ORTHOPEDIC SURGICAL PATIENT

Nurses will remember from their surgical nursing experience that hemorrhage, wound infection, and pain are the three great obstacles to success in surgery In orthopedic surgery, impairment to circulation due to mechanical obstruction must be added Nurses should be alert to symptoms which indicate the presence of any of these conditions

GENERAL CONSIDERATIONS

A great number of reconstructive operations on bones are done for people past middle age Steindler states that where the constitutional background of the patients is abnormal, it will have a definite primary influence upon the surgical risk It is for this reason that laboratory tests are done on rather a large scale In addition to the routine laboratory tests done on all surgical patients—blood count, hemoglobin estimation, bleeding and clotting time, urinalysis—the orthopedic surgeon often requires determinations of serum calcium, phosphorus, and phosphatase, as well as of the blood sedimentation rate All these things are especially necessary in older persons in whom the surgeon suspects that metabolic changes may have taken place in the bones Renal function tests are sometimes ordered because of the fact that certain anesthetics offer a definite threat to the patient having kidney damage Surgery adds a heavy burden to the kidneys by diminishing body fluid through perspiration, lack of ability to take fluids properly over a period of some hours or days, vomiting, and hemorrhage Nurses should be able to read laboratory sheets with some degree of facility and intelligence in order more satisfactorily to understand their patients' condition Understanding *preoperatively* the risk facing the individual patient will enable the nurse more confidently to assist in his recovery A high sedimentation rate is not a good prognostic sign Excessively high or low blood pressure may lower the patient's vital capacity Specific gravity of less than normal in the urine adds to the gravity of the outcome Blood urea nitrogen of over 35 mg per 100 c c of blood indicates a considerable degree of kidney damage It is a well known fact that postoperative

limbs are braced and swung forward together This is a rapid gait, but does not simulate normal walking

TRIPOD CRUTCH GAIT —The tripod gait is often taught patients with severe involvement of the lower extremities The right crutch is advanced first then the left crutch, and the body is then dragged up to the crutches If the upper extremities and shoulders are strong, the patient can use the swinging crutch gait For this gait the crutches are placed together in front of the body The patient then bears down on the crutches and lifts his body so that it is brought up to the crutches The next step in advance of this method is the swinging through gait, where both crutches are placed ahead and the body lifted and swung *beyond* the crutches This is more involved than the first swing gait since the body is swung through the crutches and therefore comes to the floor ahead of the crutches

Hazards of Crutch Walking

Everything possible should be done to insure the patient's safety, for a fall is extremely hazardous after so long a period of inactivity Even a mild mishap may lead to a fracture When the patient begins to walk, there should be one worker in front and one behind him He should not be encouraged to lean on his assistants but he should feel confidence in their presence at all times Care should be taken to see that no wet spots loose rugs or other obstacles to safe walking are near the patient Crutch tips must be intact and should be replaced when there is any sign of thinness in the rubber Suction crutch tips, as the name implies adhere to the floor surface and decrease the possibility of the slipping of the crutch

Common errors for which the nurse should be alert are walking with knee and hip flexed, the foot everted, and the hip in outward rotation a tendency to walk with the weight on the ball of the foot and with the heel elevated, and a slouching posture, with the eyes fixed on the floor, the chin on the chest and the shoulders and back rounded

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mortality in nephritis with hypertension is high Any patient who has been confined to bed over an extended period is not considered a good surgical risk

Dehydration, present or threatened, is an outstanding danger which may be recognized preoperatively Increase of fluid intake is of greater value before operation than afterward A daily intake of at least 3,000 c c containing a high percentage of glucose is advisable, and a diet pre dominating in carbohydrates is advised by some authorities for forty eight hours preceding orthopedic surgery

Delayed coagulation time demands special treatment Frequently an intravenous injection of 10 c c of 5 per cent sterile solution of calcium chloride is given for two days preceding operation Transfusion is of greater value if it is given before operation than afterward Menstrua tion is not considered a definite contraindication to orthopedic surgery, although some surgeons will postpone the surgery as coagulation time is somewhat lengthened during this period It should always be reported to the doctor before sending the patient to the operating room

The mental condition of the patient demands respect This is par ticularly true with the spastic child Severe excitability is known to bring about acidosis When possible, the cerebral palsy patient should be allowed to obtain some mental equilibrium before surgery is done Some surgeons will scoff at preoperative psychic depression Others feel quite definitely that such depression adds to the gravity of a postopera tive prognosis, particularly where premonition of death exists Such states should be reported to the doctor by the nurse as accurately as a definite physical symptom would be

Excessive obesity causes the surgeon worry because of the impairment in respiration that sometimes accompanies it Wound infection and fat embolism are possibilities to be feared especially in these patients *A marked degree of weight loss is not considered a good indication,* as a loss of glycogen reserve is likely to exist After operation, persistence of nausea and vomiting will increase the gravity of such patients condi tion extremely, as acidosis may occur very quickly

Inhalation anesthesia is usually preferred by orthopedists, largely be cause it is a controllable anesthesia, that is, it can be at once discontinued if the patient's condition seems to warrant it Spinal anesthesia is some times used in older persons or those with hypertension Danger signals in this type of anesthesia are rapid fall of blood pressure and diminution of the respiratory rate The surgeon will usually order ephedrine in these cases

PREOPERATIVE PREPARATION OF PATIENT

Preoperatively, a general physical examination will be done by the physician His preoperative instructions will usually consist of orders for increased fluid and carbohydrate intake, cathartics, enemas, and preoperative sedation Penicillin may be administered to patients who have had osteomyelitis or some septic bone condition in former years Children are predisposed to acidosis after operation, and in their case sugar in the form of stick candy is given the night before surgery While breakfast is omitted in all surgical patients to receive general anesthesia, some orthopedists order the juice of one orange to be given two or three hours before surgery to all young children The use of strong cathartics is not recommended by most surgeons Enemas may or may not be given the night before the operation, the morning of operation, or both, depending on the surgeon's wishes Barbiturates may be given the night before surgery to insure proper rest These are especially advisable in the nervous patient and are frequently given the morning of operation also, particularly where rectal, spinal, or local anesthesia is to be used The usual preoperative medication of morphine or a derivative combined with atropine or scopolamine is used except in very young or elderly patients

Attention to the above physical and mechanical data should not shut from the nurse's mind the psychological treatment which must accompany much of the preparation of any patient for surgery Most orthopedic conditions are not acute The patient has perhaps looked forward to this operation for some time Probably, if he is an adult, he has debated the advisability of having the procedure done over a long period of time The emotions he feels are a mixture of hope and doubt—hope perhaps that he will regain the use of a long paralyzed limb, fear that the surgery and long convalescence may prove of no avail It is a great moment in his life, and the nurse should recognize this She should realize that the difference between the operative procedure on the orthopedic patient and that done for the ordinary surgical patient lies in the hope he has that some lost function of his body will be restored to him This hope often overrides the natural fear While preparing the operative site, the nurse has opportunity to establish rapport with the patient, to listen to his story, that she may gain some knowledge of his social background Also, it is a good time to explain to the patient just what will be his own part in his recovery and the necessity that will exist for patience and cooperation to insure a successful outcome

PREPARATION OF OPERATIVE SITE

Because the consequences of infection in bone surgery are so grave and may quite frequently lead to crippling through stiffness of the joints, or chronically infected bone, the preparation of the operative site must be done carefully and conscientiously The exact procedure used will vary from clinic to clinic. Recently, however, there has been a tendency to omit the long forty-eight or seventy two hour sterile orthopedic preparation The orthopedic patient may be given a preparation similar to that given the general surgical patient

The antiseptic solutions used vary in different clinics The method of preparation, however, is much the same It is now well recognized that mild soap and water are probably the best agents we have not only for removing dirt and grease from the skin but also for getting rid of bacteria safely and effectively Some surgeons feel that no other antiseptic is necessary for sterilizing the skin

After the preliminary cleansing of the skin, shaving is the next step in the operative preparation The area to be shaved is usually designated by the doctor in his preoperative orders, but the nurse should know what constitutes the area of preparation for all types of orthopedic operation Surgery done on the toes will usually require a surgical preparation to the knee surgery on the ankle to midthigh In spinal surgery the area will depend on the site of injury or disease If high cervical the shaving will no doubt include the back of the neck and occiput and will continue to the buttocks Lower spinal fusions will include the backs of the buttocks and the upper part of the thighs and will extend upward to the shoulders If a graft is to be taken the leg will be prepared from ankle to midthigh or groin Knee operations usually indicate preparation of the leg from the toes to the groin For hips, the preparation usually extends to well below the knee and to the lower border of the ribs, the umbilicus being the limit anteriorly, the spine posteriorly The pubic area is always included The nurse will do well to remember that a preparation for operation on one joint should include preparation of the joint above This is not always a rule, but it provides a generous enough area that little dissatisfaction will be found

Nurses should develop a deep respect for the importance of the skin, recognizing the fact that the intact skin serves as a mechanical barrier in keeping bacteria out of the body Indeed, some investigators feel that a clean, healthy, and intact skin may actually have a self disinfecting

power Nothing that is done during the sterile preparation should lessen in any way the defensive powers of the skin

The shaving must be most carefully done The blade should be new and of good quality It is not a procedure to be hurried Two things can happen with a hurried shave denuding of the skin area or omitting a small field of fine hair Hair is not easy to disinfect and may be a source of infection after surgery A denuded area is a grave threat and may mean postoperative infection Most surgeons will refuse to operate in the face of it Abrasions of the skin of any sort should be reported

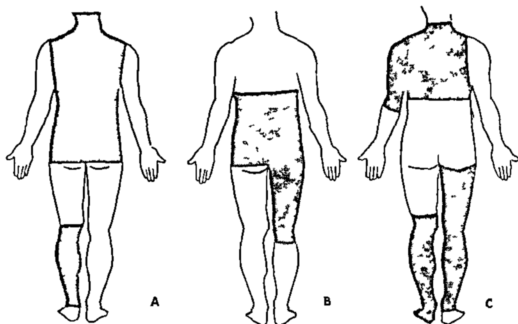


Fig 112 —*A* Drawing illustrating sites commonly prepared for surgery of the spine with autogenous graft from left tibia

B Site prepared for bone operation on hip

C Sites prepared for operations on shoulder, ankle and knee

Shaving is usually done in the direction opposite from which the hair lies, in order not to omit fine hairs in the shaving The field may need to be covered more than once to insure a clean field A wet shave is usually considered more satisfactory, but in case of emergency where it is not desirable to use water, or where the electric razor is used, a dry shave may be done

After the area is shaved, the extremity for operation must have special attention It must be washed thoroughly and be absolutely clean If grime persists on feet or hands after this washing, it should be reported to the surgeon The toe or fingernails must be clipped and thoroughly

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he should not be stripped of clothes and covering for convenience in handling A soft light woolen blanket should remain over the patient's body during the turning procedure

Certain specific articles will be needed at the bedside for the different types of surgery Shock blocks and standard are advisable items in bone operations of hip, spine, and knee A stethoscope and blood pressure apparatus are needed with all postoperative patients

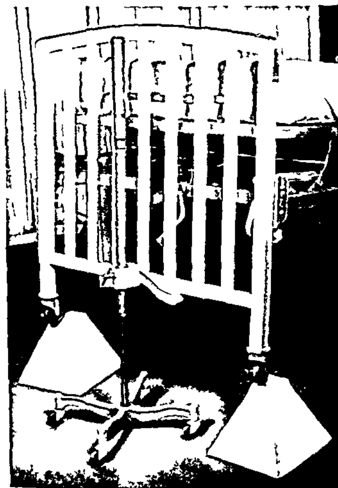


Fig 113 —A hydraulic bed lifter and shock blocks This apparatus is used frequently on a busy orthopedic service in the elevation of beds to maintain counter traction or to secure shock position

It is absolutely essential, in all cases other than the surgery of the foot or hand and arm, to have a firm bed, preferably a hair mattress, under which boards are placed from head to foot These boards are preferably placed lengthwise, but when long boards are not available,

cleaned Frequently it is necessary to soak the foot or hand in warm sudsy water for thirty minutes prior to scrubbing

After these preliminary, but important, details have been taken care of, the procedure which follows will vary somewhat according to the wishes of the surgeon In general, however, the area that has been shaved is well scrubbed with a mild soap and water for three to five minutes A brush is used for this scrubbing unless the skin is sensitive and tender, then sponges may be used The nurse must recognize that this mechanical cleansing of the skin prior to the preparation in the operating room is of the utmost importance and must be done conscientiously

A tray or basket for these preparations should be on every orthopedic service It should contain an extension light, a razor with fresh blades, unsterile towels for protecting the bed from moisture, bottles containing mild liquid soap, the antiseptic preferred by the doctor, ether or benzine, and water A small cup or basin to contain water for the shave, a paper sack, cotton balls or sponges, gloves if they are used, and adhesive tape will complete the tray

POSTOPERATIVE NURSING CARE

Postoperatively, nursing care is facilitated by having a recovery room for surgical patients Here the needed equipment to combat shock and respiratory difficulties is readily available Postoperative hazards have been greatly reduced by the timely giving of blood and the use of oxygen and suction With the well equipped recovery room, medical and nursing care can be more concentrated and extended over a longer period of time than is possible when surgical patients are returned to a busy ward However, all nurses should know the indispensable items to have ready It is usually thought advisable to make up the bed to which the cast patient will return with some type of cotton blanket because cotton blankets tend to absorb the moisture from casts better than sheets The nurse will be guided by instructions from the surgeon about the lengths to which she will go to provide postoperative warmth for the patient She must, however, expect to have the patient who is undergoing extensive bone surgery return to the ward with some degree of shock and be prepared to combat it The room must be warm and free from drafts, and in her effort to dry the cast quickly the nurse must not expose the patient to sudden changes of temperature, particularly if he is perspiring freely When the patient is turned for the first time,

he should not be stripped of clothes and covering for convenience in handling A soft light woolen blanket should remain over the patient s body during the turning procedure

Certain specific articles will be needed at the bedside for the different types of surgery Shock blocks and standard are advisable items in bone operations of hip, spine, and knee A stethoscope and blood pressure apparatus are needed with all postoperative patients



Fig 113 —A hydraulic bed lifter and shock blocks This apparatus is used frequently on a busy orthopedic service in the elevation of beds to maintain counter traction or to secure shock position

It is absolutely essential, in all cases other than the surgery of the foot or hand and arm, to have a firm bed, preferably a hair mattress, under which boards are placed from head to foot These boards are preferably placed lengthwise but when long boards are not available,

the shorter ones may be placed across the bed *A sagging bed has no place in orthopedic nursing* Almost every type of postoperative patient will need one or more rubber covered pillows However, *the use of large numbers of pillows never assures the safety or comfort of the cast patient*



Fig 114—Method of suspending long leg cast in elevated position (From Speed and Knight Campbell s Operative Orthopaedics ed 3 The C V Mosby Company)

Care in the arrangement of pillows will frequently eliminate the need for a number of them Body alignment should approximate the body alignment desirable for all bed patients *The chest should be the part of*

the body farthest forward All nurses know that this is true as it applies to good posture in any position, but frequently they forget to apply it to the patient in the hip spica cast The extremities should be supported along their entire length, not merely at one or two points such as the knee and heel Pillows placed under the head should support shoulders as well If the head is to be elevated, see to it that one pillow supports the back from the lumbar spine to the shoulders and that two pillows are arranged crosswise to support both shoulders and the head A common error is to elevate head and chest without providing for this support under the back, and the result is that an actual bending of the body occurs just above the body section of the hip spica cast This causes the edges of the cast to press against the soft portion of the abdomen and frequently results in a feeling of fullness and pressure in the abdomen which is mistaken for distention It will usually be found that once a pillow has been placed lengthwise under the cast to the sacrum, this troublesome feature can be eliminated

Pillows should be arranged so that the leg portion of the spica cast is supported along its full length so that no strain comes on the groin section always vulnerable to cracking Some surgeons prefer that sand bags be used to support the cast from the bed in order to prevent excessive weight from falling on it Sandbags may be placed under the hip, knee, and foot on the cast side so that the weight of the body falls on the unaffected side

Leg casts usually require three pillows for elevation or an overhead frame with one crossbar and a hammock which may be suspended from the frame This will eliminate the use of pillows and insure constant elevation of the limb If no cast is to be put on the body, a lumbar pad, consisting of a long narrow hair pillow, or a sheet folded lengthwise will do a great deal to prevent postoperative backache, which is still a threat even after anesthesia

Where skeletal traction is being used, it is well to have the equipment for establishing traction at hand for immediate application This will consist of pulleys for the foot of the bed, rope, foot plate, weights An overhead frame or Braun inclined plane splint may be necessary With all patients who are to have hip spica casts it is well to have the overhead frame ready with a trapeze for helping the patient to lift himself For reconstructive operations on the hip, a Thomas or Hodgen splint with a Pearson attachment, or some modification of these, will probably have

the shorter ones may be placed across the bed *A sagging bed has no place in orthopedic nursing* Almost every type of postoperative patient will need one or more rubber covered pillows However, *the use of large numbers of pillows never assures the safety or comfort of the cast patient*

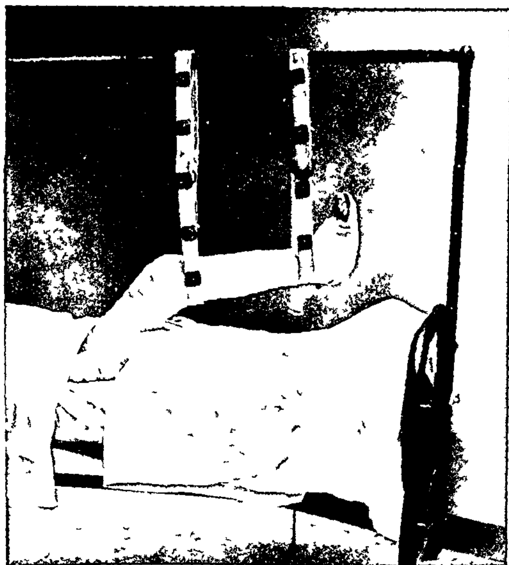


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Care in the arrangement of pillows will frequently eliminate the need for a number of them Body alignment should approximate the body alignment desirable for all bed patients *The chest should be the part of*

been ordered by the doctor The splint must be properly prepared, with the Pearson attachment in place Small towels, or preferably six inch-wide bandage strips, and at least two dozen safety pins are needed for preparing the Thomas splint If desired, canvas strips and metal clips may be used in place of the towels and safety pins Buck's extension equipment should be on hand if the nurse is not sure that it will be applied in the operating room

After any type of orthopedic operation it is important that the nurse should know the limitations of activity for her patient This is essential for intelligent care and it is as unwise to restrict the patient unnecessarily over a long period as it is to allow him more activity than the doctor wishes Every orthopedic nurse should make it her business to ascertain the limits within which she may work with her patient Is he to be allowed to feed himself? When and how often may he be turned? Will he be allowed to lie on his side with proper support, or is the prone position more advisable? May he have his back rest elevated at intervals? It is also well for the nurse to inspect the cast early Are all the toes visible? Is the cast cut out enough around the buttocks for good care? (It is almost never necessary for the cast to come down over the gluteal crease, and if it is left in this fashion, it is usually due to oversight)

It will be said many times in the course of this book that close observation of circulation of extremities in plaster is one of the nurse's chief responsibilities To quote directly from Lovett and Jones, "*Every plaster case where there is any definite slowing of the return of blood in the fingers or toes or any considerable swelling of fingers or toes should be immediately bivalved, the lid removed, and all constricting soft bandages cut through The latter point is more important*" (The italics have been added because the writer feels that for nurses at least no sentence in that venerable textbook, *Orthopedic Surgery* by Lovett and Jones, has more significance)

It must be remembered, too, that apparatus or casts applied for the remedy of acute conditions, such as fractures, osteomyelitis, or septic joints, may be followed, or rather are *likely* to be followed, by constriction and circulatory embarrassment as late as three or four days afterward The cardinal symptoms for the orthopedic nurse are (1) pain, (2) color—cyanosis, anemia, or blanching, (3) swelling, (4) depressed local temperature, (5) diminished sensation, (6) loss of motion, (7) sudden elevation of temperature which cannot be accounted for



Fig 115 —Illustrating placement of pillows to support long leg cast Note that the support is continued along the entire limb in order to eliminate strain on any muscle group The patient s foot extends beyond the edge of the top pillow thus preventing pressure or weight on the heel With some patients it will be necessary to place a sandbag or trochanter roll along the lateral aspect of the thigh to prevent external rotation of the extremity

Fig 116 —With the type of *bed illustrated short leg casts may be elevated by* raising the knee roll and the lower portion of the springs

and, where the wound is a clean one, care should be taken to see to it that the re enforcement is sterile to avoid contamination by capillary action This means, of course, that the dressing should be applied with a sterile forceps The practice of placing sterile dressings on a wound by hand is uniformly condemned by surgeons

POSTOPERATIVE COMPLICATIONS

Nurses caring for patients who have had bone surgery should be familiar with the symptoms of fat embolism This condition will usually occur within the first twenty four hours but can be distinguished from symptoms of shock by the fact that it usually does not occur until twelve hours after surgery Where the pulmonary vessels are involved, symptoms are rapid breathing increased pulse rate, and pallor followed by cyanosis Some war surgeons have noted that the condition is often accompanied by petechiae over the chest and shoulders If the fat embolus is in the brain, it will manifest itself in delirium, pupillary changes, twitching of the muscles, and coma The condition is severe and frequently fatal The patient must be kept absolutely quiet If he is in a cast, no attempt should be made to remove it in trying to save his life Intravenous therapy, heart stimulants, and artificial respiration may be ordered

Thrombophlebitis may occur as the result of immobilization or enforced bed rest The causes of this condition are a general slowing of the blood flow, collapse or compression of the veins, and endothelial damage Complaint of pain in the calf of the leg, swelling, or heat and redness of the extremity should be reported immediately to the attending surgeon Rest, avoidance of sudden movements, and elevation of the extremity are usually ordered as treatment When an anticoagulant (dicumarol, heparin) is prescribed, prothrombin time is secured daily To prevent dislodgment of a clot, the surgeon may desire to interrupt the involved vein or veins

Pulmonary embolism is another grave complication which sometimes follows surgery It comes on much later than fat embolism, usually in from ten to twenty days, although it may occur much later If the embolus is large, death may occur instantly If there is a partial block the patient will complain of sudden severe chest pain

Gradual stretching of nerves may bring about epileptiform convulsions These are not as grave as the convulsions which accompany fat embolism and occur later, usually from two to six days after operation The

ORTHOPEDIC SURGICAL DRESSINGS

Dressing of orthopedic surgical wounds should be done with the most scrupulous technique Patients having infected wounds should be segregated from clean ones, preferably in a different ward or room Clean wounds are always dressed before infected ones, and there should be a separate dressing tray or cart for use on infected wounds Greater control of environment is, of course, possible if a special room is set aside for dressings Wartime experiments showed conclusively that many hazards exist in wound dressings which were not formerly recognized as being important If, for example, clean and infected bone cases are housed in the same open ward, the bedclothing may be a source of contamination Bedclothes contain great quantities of lint and dust, and if they are exposed to purulent discharges from wounds and dressings, these particles may be loaded with bacteria The gradual spread of certain strains of bacteria through an entire ward by this method was demonstrated forcefully during World War II

For this reason some orthopedists make it a rule not to do dressings until at least one hour after all the beds have been made, in order that dust and lint may have a chance to settle Sweeping or dusting is never done during dressing periods Even turning a patient in bed may be hazardous in that it will let loose quantities of lint and dust Blankets and soiled linen should be carefully handled and never shaken out in the ward as the beds are made They should not be thrown on chairs or on the floor where dust and lint may be deposited It is preferable to have containers for soiled linen in the ward where the linen can be placed immediately as it is removed from the bed rather than having it carried to a central linen hamper outside the ward In some institutions, nobody is admitted to the ward during the dressing period, and windows and doors are kept closed Doctors, nurses, and the patient wear masks while the dressing is being done

Bandage scissors are sometimes a source of infection in doing surgical dressings It is inexcusable to cut the outer dressings of both infected and clean wounds without disinfecting the scissors between them In removing dressings, it is wise to cut the bandage and remove it in one piece Unwrapping soiled bandages may fill the surrounding air with bacteria loaded lint which may infect other wounds It is considered safer not to touch anything with the hands until the outer bandage is applied unless the hands have been washed in the meanwhile All saturated dressings should be re enforced immediately they are observed,

techniques used by nurses in preoperative skin preparation and in post operative dressings should be as nearly faultless as it is possible to make them

The prevention of wound infection will depend to a large extent on attention to the following details

1 Careful skin preparation preoperatively
2 Meticulous operating room technique
3 Observation of wound site to keep dressings and cast intact and free from contamination
4 Careful dressing cart technique—masks, use of forceps rather than fingers, segregated space for dressings, etc
5 A *clean* ward for *clean* cases where no infected bone conditions are housed simultaneously

Postoperative drainage from clean surgical wounds should be reported by the nurse as soon as observed Staining of the cast either by serum or by purulent drainage must be watched for Immediate re enforcement of saturated dressings with a sterile pad so that capillary action will not bring about further contamination is important

Children who have been walking barefoot are often predisposed to tetanus infection When dirt is grimed into the soles of the feet before surgery, it is sometimes difficult to attain the surgical cleanliness desired The physician should be informed of this circumstance before the sterile dressing is applied Occasionally, prophylactic antitoxin may be given to these patients before surgery is done

EARLY AMBULATION AFTER ORTHOPEDIC SURGERY

Although in surgical conditions which are not of the skeleton, bed rest is being whittled down to very short periods, a certain amount of recumbency is still indispensable for many orthopedic patients Neverthe less, even in orthopedic wards the tendency is to promote as early ambu lation as is compatible with the healing time of bone

New sets of skills are necessary for the nurse who wishes to help her patient toward an early and uncomplicated convalescence, there is nothing helter skelter about the procedure It requires wisdom and understanding and knowledge of new techniques It is not merely a matter of saying 'arise and walk" Equipment for getting the patient ready for being up is seen in most hospitals today One sees trapezes on many beds and portable overhead frames of lead piping on wheels, which make it possible for patients to exercise arms and shoulders for

dyspnea is slight, the pulse does not become increased, respiratory rate is approximately normal, and recovery may be expected after two to four days Treatment is removal of plaster, and sedation

The presence of backache after operation due to the complete relaxation of the muscles of the back during anesthesia is so commonly known that it seems hardly necessary to mention it here It is almost axiomatic that the lumbar spine be supported with a firm pad during anesthesia and after return to bed to prevent this disturbing postoperative complication

Urine retention may occur in patients having orthopedic surgery It is frequently necessary to catheterize adult patients who have had back or hip surgery This may continue to be a problem for several days postoperatively, and the utmost care must be taken to prevent cystitis or kidney infection

It is not uncommon for the adult patient who has had major orthopedic surgery to have abdominal distention Rectal tubes, enemas, and neostigmine methylsulfate may be ordered to relieve discomfort In some instances relief is not secured until Wangensteen suction has been started

The alert orthopedic nurse will provide nursing measures to prevent postoperative pneumonia This applies to any surgical patient but is of special importance for older persons They must be encouraged to cough up mucus and to do deep breathing exercises Their position has to be changed frequently and as much activity as possible should be permitted

The risk of operative intervention on spinal deformities of great extent (severe scoliosis or kyphosis) is increased by the effect these deformities have upon the rib cage, the lungs, and heart The large vessels of the thorax, too, may be affected Severe scoliotic patients should be observed postoperatively for dyspnea, cyanosis, and edema of the lower extremities

PREVENTION OF WOUND INFECTION

In surgery of bones and joints, the greatest possible care is exercised to prevent infection The good outcome of most orthopedic operations depends largely on bone union, and bone will not unite in the presence of infection Furthermore, the presence of postoperative infection of bones and joints often leads to lifelong crippling For these reasons,

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using crutches Sawed off crutches are often provided the badly involved patient for learning how to manage crutches while still in bed Footboards are used for support and for maintaining the standing reflex Pulleys and ropes for resistive exercises are not uncommon Printed lists of simple instructions for bed conditioning exercises prescribed by the physician are seen attached to the patients' beds

Present day nurses know that standing is preferred to sitting for the patient's first out of bed periods, and they understand the relationship of the cough and the elimination of the mucus plug to his welfare Standing is almost always preferred to sitting in early rising after surgery There are certain dangers which attend the patient who is allowed up early only to sit for many hours in a chair For patients who *must* sit, it is important to see that the seat is not too long, for a long seat causes pressure on the popliteal vessels, with the inevitable danger of thrombosis A backward tilt to the seat is preferable as it serves to keep the hips from slipping forward toward the edge of the chair—a posture which encourages sagging shoulders and rounded back Care should be taken to see that the elderly thin patient does not sit with his legs crossed, because of the danger of peroneal palsy from pressure on the very superficial peroneal nerve on the outer aspect of the knee

The procedure for getting a patient out of bed by having him turn to his side, flex his hips and knees as though sitting, and then swiveling him gently to the sitting position, is entirely acceptable in orthopedic nursing, but unfortunately most orthopedic patients are encumbered with apparatus which makes getting him up a much more complicated procedure Nevertheless adaptations may be made to fit the needs of each patient without too much difficulty, if sufficient help is available

Chapter 7

ORTHOPEDIC LINEN AND RESTRAINTS

The problem of restraining orthopedic patients on apparatus has never been solved to the satisfaction of all Many valuable contributions, however, have been made by different institutions toward the solution of some of the most troublesome of these problems How can a child be safely and adequately restrained on a Bradford frame? What methods can be used to make a neat, warm bed around traction apparatus without sacrificing traction efficiency? What type of wheelchair restraint will encourage good sitting posture in the crippled child? These are only a very few of the questions that nurses attempt to solve daily in the care of their patients

Any restraint used should assist, not retard, the good bed or chair posture of the patient It should be a *safe* restraint, which does not threaten the child s welfare if it *does* become disarranged It should be efficient in that it accomplishes its purpose If it does not, it may be worse than no restraint at all

ORTHOPEDIC LINEN

Orthopedic or fracture linen is a part of the equipment of many hospitals This linen consists of specially prepared sheets, spreads, and blankets, usually divided in such fashion that they can be applied to the traction bed without in any way disturbing the ropes or weights Some institutions get along without spreads or blankets, using old blanket pieces to augment such sheets and using a second sheet on top of the bed in place of a spread To keep the leg in traction warm, sometimes a flannelette hose, such as the kind used in surgery or obstetrics, is opened and supplied with tapes so that it can be slipped over the foot and leg in traction and then tied securely A small sheet of flannel with tapes attached may be used in place of the stocking

Sheets are commonly used to cover Bradford frames Sometimes these are merely laid on the surface of the frame, but there is consider

able danger of wrinkles unless it is possible to smooth these out several times during the day Sheets fastened with safety pins prove satisfac tory, but the time element is something of a worry in using many pins Bradford frame covers cut to fit three sizes of frames—large, medium, and small—with tapes sewed at the sides at two inch intervals are par ticularly convenient for quick changing It has been found that only three sizes are necessary, as alteration is possible because of the tapes

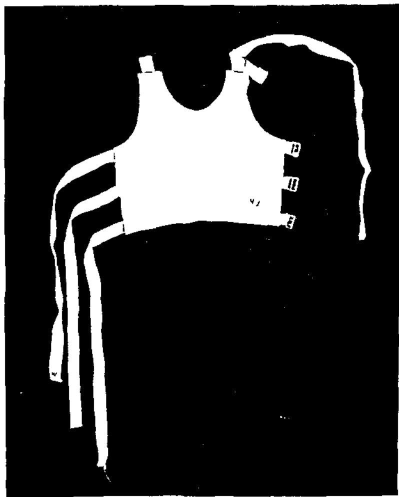


Fig 117 — Vest or jacket restraint for use with or without frame (From Care of Infantile Paralysis in the Home A Hand Book for Parents, prepared by A Steindler and T J Greteman Courtesy Arthur Steindler)

It is much easier to tie on such a cover over the canvas than to pin on a sheet, and furthermore the use of sheets for this purpose is uneconomi cal in that it *frequently results in many tears in the linen*

Fig 118 —Method of making the end of an orthopedic bed

Fig 119 —Orthopedic bed completed

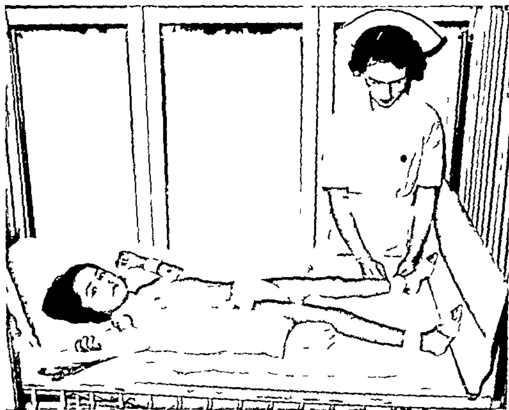


Fig 120 — Michael Reese restraint splint made of unbleached muslin Cheap, washable and convenient Can be used in poliomyelitis birth palsy or for maintaining position in many other conditions



Fig 121 —Wheel chair restraint front view

ORTHOPEDIC RESTRAINTS

For frame restraints, a harness restraint, Y shaped, with the arms of the Y going over the shoulders and the base of the Y to the foot of the frame, is very frequently used Crosspieces at the level of the child s

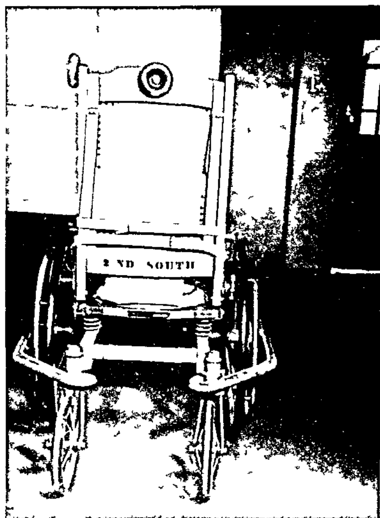


Fig 122 —Wheel chair restraint rear view

hips and abdomen fasten under the frame with buckles, and the arms and base of the Y are also fastened by buckles to the head and foot of the frame

A jacket or vest restraint like the one illustrated provides fairly satis factory immobilization for the child on a frame There is some danger

in all types of jacket and harness restraint if the child slips down in bed, and this must be borne in mind

The use of Ace bandage for securing young children to frames is preferred in some institutions Where this method is used, the bandage should be three to four inches in width Muslin or gauze bandage should never be substituted, as the lack of elasticity in the bandage may constrict the child's chest or abdomen

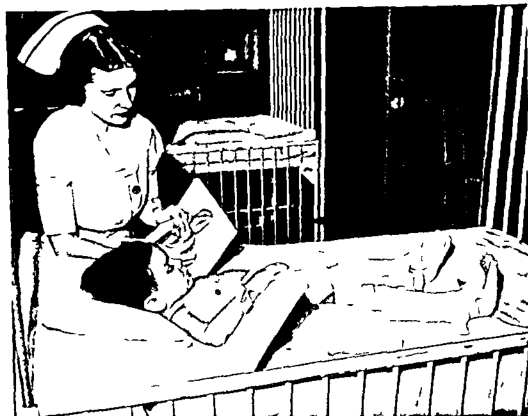


Fig 123 —*Homemade arm supports of wood covered with silence cloth Straps and buckles for wrists are sewed to cloth Convenient for maintaining neutral position of shoulder and arm Convenient for use in hemiplegia, burns of shoulder and trunk poliomyelitis etc*

Restraints should never come too near the child's neck, since with any alteration of his position, they may embarrass respiration Restraining pieces should not cross under the arms, since, if the child slides down in bed, the shoulder girdle may be elevated into a position of deformity Crosspieces should not be too tight over the chest as they foster poor habits of respiration A crosspiece over the abdomen should not be tight enough to cause distress after eating

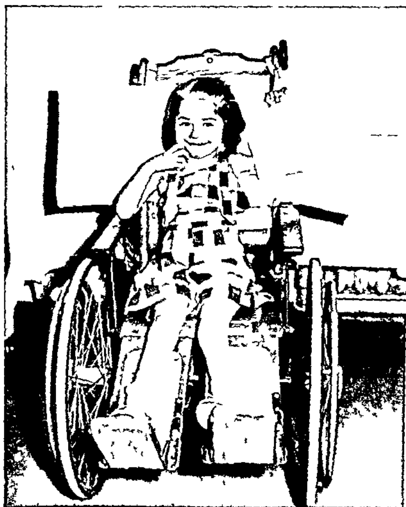


Fig 124.—Wheel chair with improvised arm support Board is suspended by straps and buckles from top of chair Arm towel pinned to board Suitable for temporary support after surgery for brachial palsy poliomyelitis peripheral nerve injury etc

Where wrists are tied over the head, the nurse should be very sure of the type of knot she is using, as a slip knot may be the cause of serious circulatory disturbance in constricting the wrist

Orthopedic beds may be made with top linen placed over the end of the bed, rather than by tucking it in at the end of the mattress Pinning this linen with safety pins at the corners will secure the end of the bed neatly Merely tucking the ends in does not provide for permanent position of the upper covers

Wheel chair restraints should provide for good sitting position for the child Hips should be maintained in contact with the back of the chair, shoulders should be persuaded to an upright position, so that stooping forward does not occur as the child operates the chair

No restraint is foolproof and all of them need constant adjusting

QUESTIONS FOR STUDY—UNIT II

1 You have been assigned the care of a patient who has been placed in a hip spica cast

a What preparation will you make prior to the patient s return from the plaster room?

b Describe placement of pillows to support the wet cast

c What observations will you make pertaining to circulation of the extremity enclosed in the plaster?

d Describe procedure you will use for turning this patient to his abdomen

e When placing the patient on a bedpan, what nursing measures will you use to protect the cast and to insure comfort for the patient?

f When the cast is dry how will you finish the cast edges?

g If the cast becomes soiled how will you clean it?

2 Construct a brief nursing care plan for the patient newly removed from a hip spica cast

3 Bleeding noted by staining of the cast after surgery can be checked for progress by what simple method?

4 Describe a desirable setup for doing clean orthopedic dressings in an open ward

5 Discuss early ambulation in the treatment of orthopedic patients

6 Discuss reasons for applying traction

7 Describe several methods of securing traction

8 Distinguish between skin and skeletal traction List several types of skin traction

9 What is meant by a Balkan frame ?

10 When is Bryant s traction used?

11 Distinguish between Buck s extension and Russell traction

12 List observations you would make when caring for the traction patient pertaining to the following position of extremity position of patient in bed counter traction, weights footplate

13 What are some of the areas which frequently become denuded after the application of Buck s extension?

14 Why is it important that no pressure be exerted on the head of the fibula in applying traction?

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Unit III
CONGENITAL DEFORMITIES

Chapter 8
CONGENITAL DEFORMITIES

Deformities which are present at birth are considered congenital They may follow hereditary patterns or they may be the result of embryologic defects It is generally believed that intrauterine mechanical factors as well as nutritional deficiencies produce multiple defects in visceral organs as well as muscles, bones, and joints The types and variations of deformities are almost limitless and many are not disabling Those encountered relatively frequently will be described in this chapter

CONGENITAL DISLOCATION OF THE HIP

The term congenital dislocation implies that the head of the femur is outside the confines of the acetabulum at birth Actually there are degrees of dislocation, from incomplete to complete, and these are identified by definite terms

Subluxation, or predislocation, is an incomplete dislocation This is more common than dislocation and more difficult to detect If untreated, however, many subluxations eventually result in complete dislocations and for this reason they assume importance in early recognition

The exact cause is unknown but the defect is primarily in the lack of proper acetabular development This does not cause symptoms, but when certain signs are present the condition should be suspected and verified by an x ray of the hips Limited abduction of the hip in the flexed position and/or a click sign while abducting the hip are the most useful objective findings Treatment, consisting of a Frejka pillow splint, should be instituted immediately

Congenital dislocation refers to those cases in which there is an actual complete dislocation This can occur during intrauterine life or follow

in the wake of an untreated subluxation sometime after birth In either case it demands early recognition and treatment to obtain a satisfactory result



Fig 125 —Congenital dislocation of the left hip Note prominent trochanter on the affected side and asymmetry of gluteal folds

The signs vary with the age of the child Walking is often delayed, and prior to this the mother may have noted an extra gluteal fold on the affected side Occasionally it is brought to attention by a shortness of the leg, an unusually broad perineum (especially in bilateral cases), or an unusual prominence of the trochanter Should the dislocation be unrecognized until walking begins, the most obvious disturbance will be a waddling type limp On examination at any time it is usually apparent that the affected leg is shorter the range of hip motion is freer than normal, there is lack of stability on the push test, and the trochanter is higher than normal In standing the child will demonstrate a positive Trendelenburg test A positive Trendelenburg test is

indicative of an unstable hip joint. When the body weight is taken on the normal or stable hip, and the affected limb elevated, the pelvis on the side of the dislocated hip rises—this is true with normal hip joints. However, when the body weight is taken on the dislocated hip and the good limb elevated, the pelvis drops on the side of the good limb. To compensate for the pelvic drop, the body shifts to the opposite side, and this mechanism maintains balance.

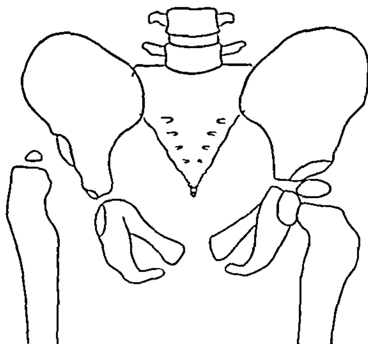


Fig. 126.—Copy of x ray of congenital dislocation of right hip. There is upward and backward displacement of the head of the femur and thickening at the base of the acetabulum (prenatal).

Treatment must be started immediately the diagnosis is made. The aim is to reduce the dislocation to a normal position, and this is ordinarily accomplished by a closed manipulation under anesthesia. The reduction must then be maintained for a time sufficient to allow the acetabulum to develop to a point that will maintain reduction. This may take a matter of months, during which time the hip will be immobilized in a plaster spica and the surgeon in charge will vary the position to suit proper placement of the femoral head within the acetabulum. Various splints are available as substitutes for plaster casts and have the advantage of being removable. These are more applicable in the later stages of treatment.

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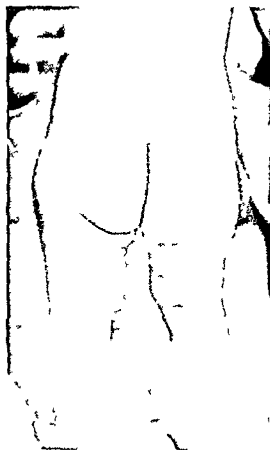


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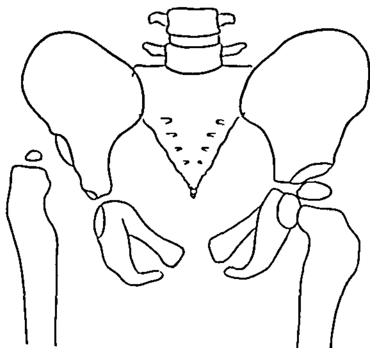


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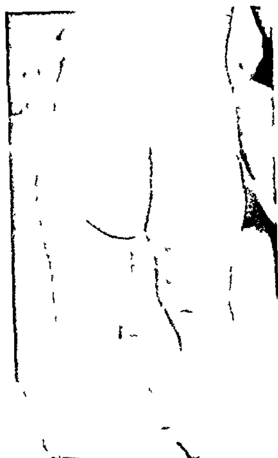


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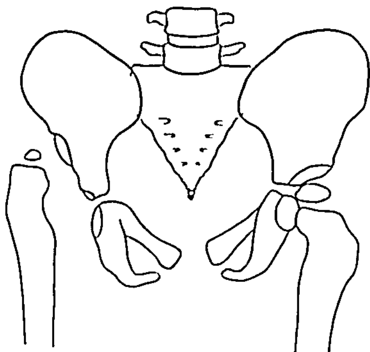


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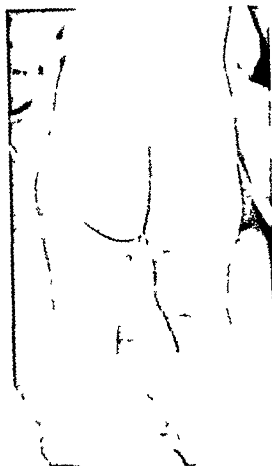


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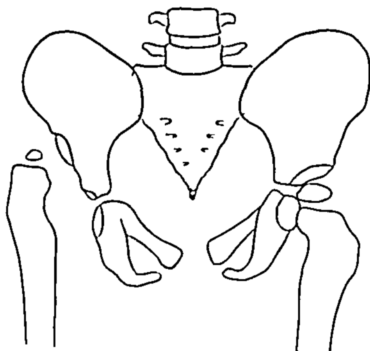


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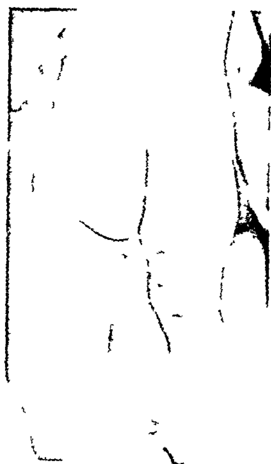


Fig 125 —*Congenital dislocation of the left hip Note prominent trochanter on the affected side and asymmetry of gluteal folds*

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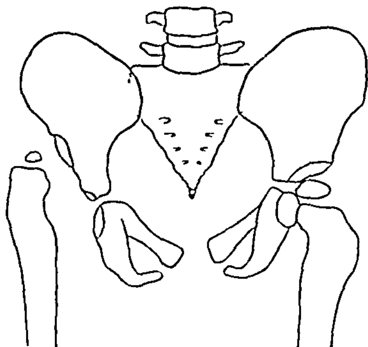


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Operative reduction is necessary where closed manipulation has failed to correct the dislocation The aftertreatment is similar to closed reduction both in time and type of fixation apparatus

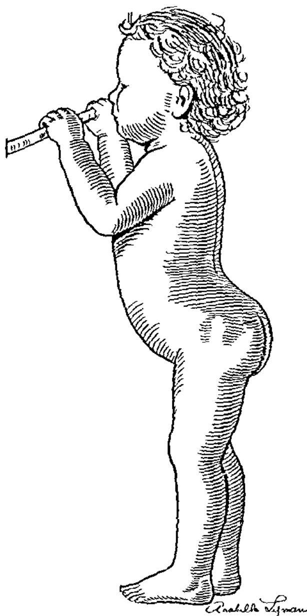


Fig 127 —Bilateral congenital dislocation of the hip in older child Note prominence in gluteal region and sway back The sway back position compensates for the backward *displacement of the hips*

Late Results of Congenital Dislocation of the Hip —Where treatment was started early (within first eighteen months of life), the outcome will be excellent A few cases treated early and many treated late will

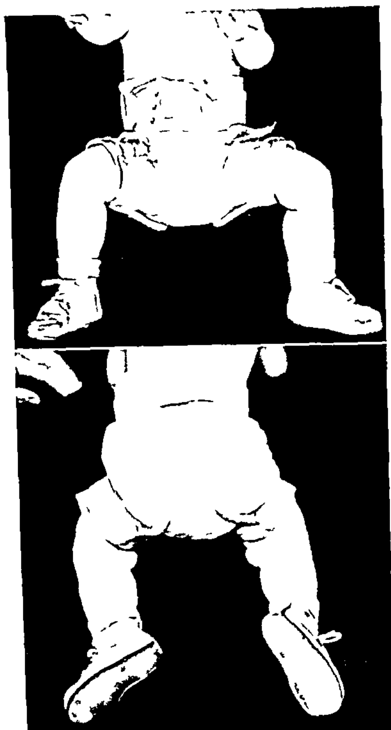


Fig 128—Anterior and posterior views of splint used in treatment of congenital dislocated hip

show degenerative changes of the hip by the time middle life has been reached These degenerative changes cause painful disability sufficient to require further treatment For the details of treatment at this stage as well as for unreduced dislocations found in adults, see Arthroplasty of the Hip, Chapter 26

CONGENITAL CLUBFOOT

Congenital deformities of the foot are of many types and are primarily hereditary since they can frequently be traced through several generations The typical clubfoot (see Fig 130) is composed of three main elements of deformity, i e, equinus, varus, and forefoot adduction, hence the common term, talipes equinovarus, derived from the Latin

Intrauterine positions of the foot can easily be mistaken for true club foot deformity, but examinations will reveal the difference A true clubfoot, if examined, cannot be corrected to neutral position in all elements of deformity, whereas a positional apparent deformity corrects itself quite readily This is important to decide, since treatment should be begun immediately a true clubfoot can be shown to exist, whereas a positional clubfoot needs no special treatment This holds true for other foot deformities, such as talipes adductus and calcaneovalgus

A true clubfoot may be unilateral or bilateral and occurs not infrequently in association with other defects such as spina bifida and arthrogryposis In any case of clubfoot, therefore, other defects should be carefully looked for in making examination

Treatment of a clubfoot is, in most instances, quite successful The principle of the treatment is to attain correction of all elements of deformity by manipulation and to hold correction throughout the early growth years This has been accomplished by various techniques, ranging from simple adhesive strapping to manipulation under anesthesia One thing that time and experience have taught us is that excessive force can be harmful to the growing centers The most common technique used is repeated manipulations and plaster casts By this method the foot is stretched gently into a corrected position and a cast is applied to hold the gain This is repeated at intervals of a few days until correction is attained, which may require ten or more manipulations over a period of several months Weight bearing plus some type of retentive apparatus at night will usually maintain correction

Many variations may be made in an effort to accommodate prolonged treatment to specific needs in each case Frequently one element of deformity, namely equinus, will be more resistant to treatment and will



Fig 129 —Forefoot adduction of the right foot



Fig 130 —Bilateral clubfoot (talipes equinovarus)

require special effort even to the point of operative correction In other instances muscular imbalance will prevent maintenance of correction so that operative transfer of tendons will be indicated, such as shifting the tibialis anticus pull to a more lateral position

In addition to the therapy outlined, it is important to follow these cases until growth is complete to be certain that recurrences of deformity do not occur

CONGENITAL ELEVATION OF THE SCAPULA

(SPRENGEL'S DEFORMITY)

Symptoms and Signs —Deformity is apparent in the upper part of the back One or both shoulder blades are high There is usually some limitation of the movement in the shoulder joints



Fig 131 —Sprengel s deformity

Anatomy —It is the opinion of most authorities that the term con genital elevation' is a misnomer since the scapulae, during the period of development, are normally high but descend and rotate before birth It is therefore actually a failure of descent of the scapulae The de formity may be associated with other congenital deformities such as

abnormalities in the shape of the vertebrae, webneck (Klippel Feil syndrome), and possibly other deformities

Treatment —The treatment of choice is that recommended by Schrock This consists in the complete subperiosteal and submuscular release of the scapulae, followed by rotation of the bone within this compartment to its normal position Treatment follows with a period of immobilization for a few weeks, allowing reattachment of the periosteum The scapula is now in its normal position In properly selected cases in younger children this treatment gives complete correction of the deformity

ABSENCE OF BONES

(TIBIA, FIBULA, RADIUS, FINGERS, TOES, ETC)

Clinical Picture —

1 A child may be born with whole extremities or parts of the extremities missing, or with various bones missing

2 Extremities or digits may be partly missing and there may be constricting bands or circular creases

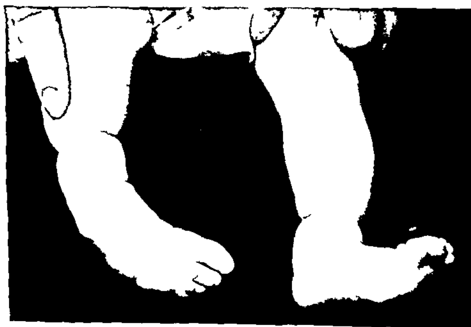


Fig 132 —Amnionic bands and bilateral clubfeet

Causes —

1 Absence of bones seems to be caused by arrest of development during the early stages of embryonic growth

2 Constrictions and retarded development in the extremities are thought in many instances to be due to amniotic bands or scars or intra uterine constrictions

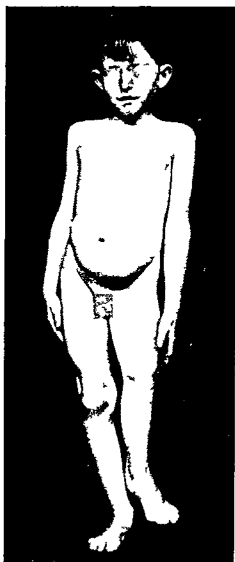


Fig 133 —Congenital shortening of the left femur

Anatomy —The deformity which develops from the absence of a bone is always characterized by loss of the propping or strutting effect of this bone If a radius is missing, the hand is at right angle to the forearm in a direction pointing toward the face (clubhand) It is not unusual to find associated deformities such as absence of the thumb and the presence of a cervical rib

When the absence of bones occurs where there is an *associated* bone such as in the forearm or in the lower part of the leg, the other bone usually becomes enlarged but is frequently deformed When there is an absence of tibia, the leg is usually shorter and the foot tends to turn inward and backward

Congenital deformities of this type include short and underdeveloped limbs due to growth deficiencies Occasionally, one leg or one arm will be underdeveloped so that it is only about one half the length of the opposite one

WRYNECK

(Torticollis)

Signs and Symptoms —At birth or shortly after, the child may have a tendency to hold the head to one side On palpation of the neck a mass may be felt in the sternocleidomastoid muscle There is limitation of motion in attempts to move the head away from the affected side

Cause —There is an engorgement of the muscle as a result of over stretching during the passage through the birth canal

Some observers hold to the theory that the affected muscle was inherently weak before birth

Anatomy —After the tearing occurs in the muscle, there is hemorrhage and extravasation of blood into the fibers During the healing process this undergoes organization and the development of scar tissue The scar so completely involves the muscle fibers that elasticity is lost and contraction occurs As the child grows older, this also leads to the development of a facial asymmetry

Treatment —In most cases of congenital wryneck discovered shortly after birth, correction and cure can be assured within a month or two by the daily use of heat, massage, and carefully regulated stretching Chandler contends that the muscle mass should be removed

In cases which have gone untreated or unrecognized, fibrosis takes place in the muscle and permanent deformity develops Operative treatment is necessary This consists in the resection of the tendon of the muscle from both the sternal and the clavicular attachments Usually about three quarters of an inch of the tendon is removed

There are various methods recommended for maintaining correction after operation but probably the safest is the application of a plaster of Paris cast which includes the chest, neck, and head in an overcorrected position This requires that the chin be brought high above the shoulder of the affected side



Fig 134 —Left torticollis before correction Note asymmetry of the face rotation of the head to the right and tilt of the head toward the affected side



Fig 135 —Left torticollis following surgical correction

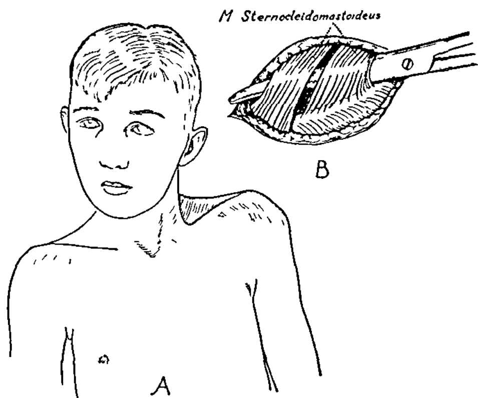


Fig 136 —Operation for torticollis *A* Line of skin incision *B* Clavicular and sternal attachments of sternocleidomastoid muscle withdrawn from wound and divided (From Speed and Knight Campbell s Operative Orthopaedics ed 3 The C V Mosby Company)

Healing Time —The cast should be left on for approximately six weeks, after removal of the cast a Thomas collar should be applied and massage and stretching continued for several weeks

SYNDACTYLISM

Syndactylism is a congenital anomaly characterized by webbing of two or more fingers or toes The web may be formed by skin alone, skin and subcutaneous tissue, and, in severe cases, there may be bony fusion between the phalanges



Fig 137 —Syndactylia between middle and ring fingers Pre and postoperative photographs

The treatment consists of surgical separation of the digits and skin grafting of the denuded areas with free full thickness skin grafts The commissure or deepest part of the web is fashioned with a flap of skin from the palmar or dorsal aspect of the web After skin grafting it is necessary to rigidly immobilize the digits spread apart in a plaster cast or splint for three weeks The best time for surgery is during the second or third year of life

Chapter 9

NURSING CARE OF PATIENTS WITH CONGENITAL DEFORMITIES

The nurse's function in the detecting and reporting of congenital anomalies is recognized to be an important one. Whether she is a hospital nurse working with infants in the obstetrical nursery, a public health nurse giving bedside instruction to the new mother, a nurse in the pediatric ward, or a school nurse, she will have many opportunities for detecting abnormalities. To do this intelligently, she must, of course, have a clear understanding of what is normal in the structure, function, and development of the child. In addition to this, she needs to know the symptoms of the common orthopedic conditions which are found at birth. And while most congenital deformities cannot be prevented, nevertheless nurses should recognize the fact that certain birth injuries can sometimes be prevented by good medical supervision and care during the period of pregnancy and delivery. They should use their influence to see that all mothers are given the benefit of good obstetrical care.

The nurse giving a bath to the newborn infant may become aware of deviations as she bathes him and watches his activities while he is unclothed. Limitation of joint motion, excessively free joint motion, limpness or a disinclination to move a part, a tendency to lie in one position constantly, alteration of body contours or asymmetrical folds in the skin—any of these conditions may rightly arouse her suspicions that something is not as it should be.

But not all congenital anomalies are detected at this early stage. Perhaps not until the child has reached the school period will an abnormality be noted, and sometimes even then the condition will be manifest only when the child is tired, when a slight limp or alteration in gait will be detected.

The importance of early recognition, of course, is that it makes early treatment possible, and early treatment is paramount in the management of these patients. Delay may make any treatment attempted only palliative. The nurse needs to recognize this factor in order to help the family accept the necessity for securing immediate medical treatment when the abnormality is recognized. However, she should be cognizant

of the tremendous emotional components in this type of condition and appreciate the feelings of the family. She will often meet parents who are afflicted by shame, pride, despair, or bewilderment, and she must be prepared to combat these reactions with sympathetic understanding and informed common sense.

"The key that opens the door of diagnosis is suspicion," says Osgood.* The nurse does not name her suspicions aloud but uses her utmost influence to see to it that the child whom she suspects of having an abnormality is given the benefit of medical examination without delay.

CONGENITAL DISLOCATION OF THE HIP

It is scarcely possible to overestimate the importance of early recognition of this condition. The results of the treatment of congenital dislocation of the hip are always best if the treatment can be begun early, if possible during the first three months of life. The possibilities of a perfect result diminish rapidly as the child grows older.

It is admittedly difficult to begin treatment during the first few months of life because only rarely can the diagnosis be made at that time. It is true that early diagnosis may be made without too much difficulty on the prenatal type of dislocation, but this forms only a small percentage of the total group. Furthermore, the results of treatment for this type of dislocation are not usually as satisfactory as they are for the postnatal type.

Nevertheless, the importance of observing the newborn for signs of the condition cannot be overemphasized. While bathing the infant the nurse might note an extra fold in the buttock or thigh, or perhaps a widening of the perineum; or in flexing the baby's hips and knees, with his feet flat on the table, she may observe that one knee is lower than the other. She might detect that all motion in the suspicious hip seems abnormally free except for abduction which is limited. When the physician's attention has been called to these observations, the nurse may see him fix the baby's pelvis with his hand and grasp the lower end of the femur to determine if piston motion, or telescoping, is present. X ray of the hip on which these signs are noted will assist the physician in making his diagnosis if an established dislocation is present.

Many congenital hip deformities are not detected in infancy and early childhood and may go on for years before they are seen by a

*Osgood, Robert B.: Compression Fracture of the Spine. Journal of the American Medical Association 89: 1563-1568, Oct. 29, 1927.

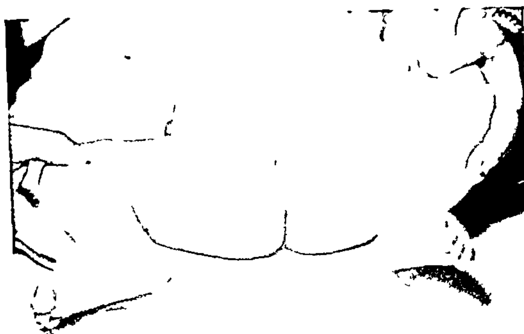


Fig 138 —Limitation of left hip abduction in an infant with congenital left hip dislocation



Fig 139 —Apparent shortening of the left thigh due to left hip dislocation The left knee appears lower Two extra skin folds are present in left thigh

specialist Nurses should be familiar with the symptoms of congenital dislocation of the hip which come about after weight bearing is estab lished The child will walk with a lurching or waddling gait, due to the instability of the femur on the affected side In addition to this, the buttocks may seem abnormally broad and there will be a lumbar lordosis accompanied by a protuberant abdomen By ten or eleven years of age, the lordosis has usually become very marked and un sightly, and a scoliosis may have developed if the dislocation is unilateral There will be shortening of the limb and often an adduction deformity of the leg will exist When this stage is reached, great difficulties stand in the way of treatment, but much can be done to insure the child a fairly stable hip and to reduce the possibility of arthritis and allied con ditions in later life

Treatment

Treatment of congenital dislocation of the hip will vary somewhat according to the age at which the child is seen and the type of dis location present *The closed reduction is probably still the preferred* method if the child is seen within the first few years of life It will usually involve the use of a spica cast, and the nursing care the child receives after this may do a great deal to determine the success or fail ure of the treatment Open reductions are sometimes necessary to sup plement the closed reduction Palliative operations, such as shelving operations and the various types of osteotomies, may need to be done if both closed and open reductions fail If the child is diagnosed during what is called the predislocation stage of the postnatal type, an abduc tion splint may sometimes be used

Nursing Care With the Frejka or Pillow Splint—The student nurse working on an orthopedic service will seldom have opportunity to care for the small patient wearing a pillow splint However, during experi ence in the orthopedic outpatient department she will undoubtedly ob serve its application and may be asked to instruct the mother in regard to the splint With this apparatus, the child can be cared for in the home The splint consists of a square pillow (stuffed with kapok) which is held in place by a 'romperlike garment The romper is made with a pocket to hold the pillow and with straps which are placed over the baby's shoulders and pinned securely The pillow part of the garment, which is placed between the baby's legs, is wide enough to maintain the thighs in abduction and flexion The splint is applied over the regular

diaper To protect it from being wet or soiled, the child must wear plastic panties, or the Pliofilm apron illustrated is placed between the diaper and the pillow

The mother needs to know why it is important for her baby to wear this splint Second, she must understand how to apply it correctly The pillow splint has to be applied each time the baby's diaper is changed, and, if the mother is not cautious, the desired position of the hip joint may not be maintained The splint is worn for several months or until x rays show a normal hip During this time, the child will need to be checked at frequent intervals by the orthopedist



Fig 140 —The Frejka splint ready for application The pillow has been placed in the pocket part of the garment

Nursing Care in the Closed Reduction Method —The closed or "bloodless" reduction method, used by Lorenz a half century ago and somewhat modified during the past twenty five years by Putti, Ridlon, and others, is probably the preferred method of reduction for children under five years of age This reduction is done under anesthesia and the child is usually placed in a double hip spica cast following the manipulation The cast is very carefully applied and well molded to maintain the reduction It may be applied with the hip in the position of 90 degrees of flexion and 60 to 70 degrees of abduction, or the cast may be applied in a position of abduction and internal rotation In either instance the double hip spica is used whether the dislocation is unilateral or bilateral Where the "frog" or Lorenz position is employed, it is usually followed in from three to four months by a change to the Lange, or functional, position, of inward rotation and abduction

The care of a young child in a hip spica cast requires forethought and ingenuity to prevent soiling and soaking Even twenty four hours of neglect can ruin such a cast hopelessly A quarter of a century ago even though a congenital hip was recognized early, the specialist often did nothing about the deformity until the child was at least two years



Fig 141 —Correct application of the Frejka splint The pillow maintains the thighs in flexion abduction and external rotation

of age Most of the pioneer workers with this condition believed that it was not feasible to try to correct the dislocation by forcible correction in infancy since the child was not diaper trained and the application of a spica cast seemed impracticable in view of the danger of soiling Reduction of congenital dislocation of the hip has long been associated with the problem of nursing care

There will usually be a stockinette lining to the cast in which the child is enclosed Some surgeons place small towels over the abdomen and back before the stockinette lining is put on the patient These towels may be changed frequently and will do a great deal to keep the baby's skin in good condition The towel edges may be pinned together on the outside of the cast after the plaster is dry In changing the towels a clean one is pinned to the soiled one, the latter is then gently pulled out

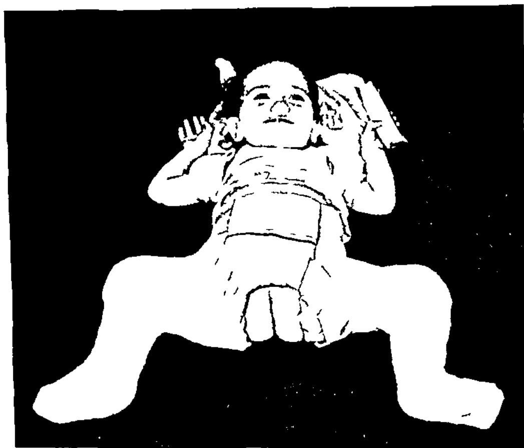


Fig 142—Arrangement of towels for protecting inner surface of hip spica cast after reduction for congenital dislocation of the hip (Courtesy Arthur Steindler)

from under the cast and at the same time the clean one is pulled into place Even though these towels are not applied when the cast is put on, they may be used on the wards A thin towel can be inserted beneath the cast with a tongue depressor, comb, or corset stay, but care must be taken to avoid pinching the baby's skin in the process

Some type of equipment should be used to elevate the cast off the bed to prevent soiling The small Bradford frame, suspended to the

crib by iron hooks or placed on boxes, provides an excellent method of elevation The Bradford frame is equipped with a two piece canvas frame cover which leaves space beneath the buttocks for the bedpan The edges of the frame should be protected by pieces of waterproof material at the buttock area A bedpan is kept underneath this opening at all times A harness or jacket restraint will be necessary to secure the baby to the frame As soon as the cast is dry it should be waterproofed against soiling



Fig 143 —Arrangement of rubber covered pillows to support hip spica cast Note space for bedpan and the folded diaper across the perineum Head of bed may be elevated slightly to help prevent wetting of the cast

The orthopedic literature is full of suggestions and descriptions of frames to be used for keeping the infant in a cast off the bed Wooden and wire frames which support the child and hold the bedpan in place have been invented for this purpose For the most part, however, the Bradford frame proves generally satisfactory The nurse may make a temporary support of small rubber covered pillows placed under the body and legs of the cast in such a manner that a vacant space is left for the bedpan under the buttocks It is always important to see to it that the head of the bed is elevated in order to prevent urine from running back under the cast Unless the body is on a slant, soaking of the cast is bound to occur

Considerable difference of opinion exists about the use of diapers Most orthopedists frown on them because they tend to become soaked across the groin area and soften the cast at the most important point,

that is, at the hip level Diapers may be omitted entirely if a frame is used If diapers *are* used, one should be folded as a perineal pad and placed across the perineum before the outer diaper is applied The perineal diaper will absorb much of the moisture and protect the cast from wetting It will, of course, have to be changed frequently



Fig 144 — Bilateral hip spica cast with affected right hip in abduction and internal rotation Sometimes called the Lange position Commonly used to maintain correction after open reduction of congenital dislocation of the hip (From Shands Handbook of Orthopaedic Surgery)

Convalescent Treatment of the Patient With a Congenital Dislocation of the Hip —The child is usually immobilized in plaster for several months When the x ray findings are satisfactory, a regime of controlled functional treatment will be begun Too long immobilization is now rather universally avoided, since it has been found to result in cystic

atrophy or epiphysitis of the hip A period of physical therapy, consisting of radiant heat, massage, hydrotherapy, and exercise, will usually be prescribed, followed by limited periods of walking This phase of the child s treatment is one in which he must be observed and examined frequently, since this is the time that redislocation may occur Nurses should understand that it is the general opinion of orthopedists at present that the main cause of redislocation is anteversion of the head of the femur To maintain the femoral head in the acetabulum in a stable manner, inward rotation of the leg is considered essential and outward rotation is usually avoided for a long period One of the things that physical therapy seeks to accomplish is to strengthen the inward rotators of the hip, that is, the gluteus medius, gluteus minimus, and the adductor magnus Functional treatment of congenital dislocation of the hip seeks to maintain abduction of the leg and to avoid outward rotation Motion in all other directions is usually permited

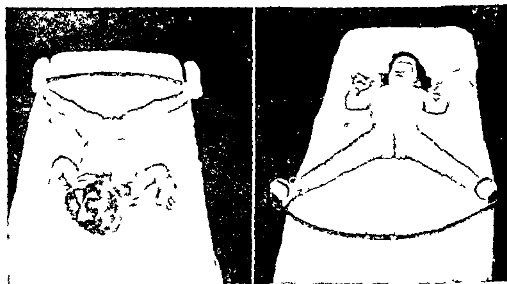


Fig 145 —Abduction bar for treatment of congenital dislocation of hips Bar is adjustable but feet are locked against external rotation Internal rotation is free (*Courtesy Arthur Steindler*)

Apparatus to assist in keeping the legs in this position is used in some localities The device pictured (Fig 145) consists of an iron bar with a plate at each end The plates are attached to the patient's shoes They are fastened in such a way that inward rotation, hip flexion and extension are possible, but outward rotation is strictly limited at 75 degrees or under There is a sliding mechanism on the bar which makes it pos

sible to increase or diminish abduction Usually the angle of the legs will be kept at about 100 to 120 degrees

This bar is used from two to six months after the cast is removed It is removed only for the daily bath, when care must be taken to see that the legs do not roll into outward rotation X-rays are usually taken every two months to check the progress of the joint and the building of the acetabulum As the child progresses, the bar may be removed and walking permitted for short periods This walking time is increased as the x ray shows progress in the development of the hip joint Night splints may be used several years following reduction of the hip to offset the chance of recurrence or redislocation



Fig 146—Adjustable chair which may be used with child in hip spica cast after reduction for congenital dislocation of the hip

Instruction for Home Care—After the cast has been thoroughly dried and "finished," and the position of the hip checked by x ray, the child may be allowed to return home The mother should be very carefully instructed about the care of the patient and the cast, and this cannot be done hurriedly if the child is to have adequate care A discussion of many details will enter into the instruction *In the first place,*

nurses should bear in mind that most mothers tend to be afraid of damaging the cast It is essential that they should be brought to realize that it is perfectly possible to give the child wholly adequate care in the cast if they will take the time to do it Methods of keeping the cast clean and dry, and care of the skin beneath the cast should be demonstrated The necessity of using the fingers under the cast must be particularly emphasized, for many times cast sores are overlooked near the edges of the cast where they should be discovered without difficulty Inexpensive substitutes for waterproofing the plaster should be suggested and methods of applying the diaper demonstrated The mother must be instructed to observe signs that the child is growing too large for his cast, and she should be made aware of the danger of a weak or broken cast and the necessity for returning to the hospital or clinic for repairs at once when this has occurred

The freedom the child is to be allowed should be discussed Most surgeons permit the child to stand or even walk in the crib if he so desires Sitting astraddle of chairs or kiddy cars is often permitted If the child's feet are not in the cast, the mother should be instructed in methods of maintaining good position for the feet With the surgeon's permission, simple exercises to prevent atrophy and loss of function in the feet can be taught Usually dorsiflexion and inversion exercises will be prescribed Where it is at all possible, a public health nurse should be notified of the home coming of a child after a hip reduction She will be able to assist the mother during the first daily bath and will be able to clear up any details which have escaped the mother s memory

Preparation for Surgery —As a preparation to open reduction or other surgery on congenital dislocation of the hip, skeletal traction may be used It has been found that this procedure will do a great deal to shorten the time necessary for reduction while the child is under anesthesia and will often eliminate the use of undue force in placing the head of the femur in the acetabulum The purpose of traction is to bring the head of the femur down to the level of the acetabulum Usually the orthopedist will maintain this traction for ten days or two weeks before surgery is done

The Kirschner wire or Steinmann pin is drilled through the condyles of the femur under anesthesia It is advisable to have the caliper attachment, weights, ropes, and pulley at the bedside so that they can be applied and the traction setup completed before the child awakes Application after waking usually causes the child considerable discomfort The caliper which is fastened to the nail or wire should not be

allowed to rest directly on the child's leg, as it will cause bruising A felt pad may be kept between the caliper and the lower leg The line of traction should be in the direct line of the femur A small pillow, covered with powdered oiled silk, may be used under the calf of the leg to keep the heel free of the bed and to prevent friction

The amount of weight necessary to bring the head of the femur down to the acetabulum will be considerable The foot of the bed may need to be elevated as much as 45 degrees to prevent the child from slipping down in bed A Bradford frame and harness restraint will sometimes aid in keeping the child in position Perineal straps may be ordered but must be used with caution, as tight adductor tendons in the groin are almost always present in congenital dislocation of the hip Prolonged use of perineal straps inevitably brings about signs of pressure at this area Faithful nursing care will be necessary to prevent breaking down of the skin It is advisable to remove the perineal straps several times daily and to massage gently the area over the tight tendons

Nursing Care After Surgery —Open reduction of the hip may be attended by a certain degree of shock during the first twenty four hours after surgery Intravenous fluids will usually be given and shock blocks may be required The child should be kept warm and observed frequently for signs of hemorrhage During the first day or two following surgery, nurses should avoid exposing the child in an effort to dry the cast It has been found that too rapid evaporation of the cast's surface sometimes cools the child's skin excessively and prolongs shock

The child will usually be immobilized in a spica cast, and after recovery from the effects of surgery nursing care will not vary greatly from that given to a child with a closed reduction

The treatment of neglected or recurrent dislocation of the hip in older children will usually include surgery Nursing care after the shelving operation or after osteotomy will be similar to that given to the child with open reduction of the hip

After removal of a hip spica cast which has been worn for several months following surgery, these patients seem to be vulnerable to fracture of the shaft of the femur due to bone atrophy which takes place during long periods of immobilization Gentle handling of the extremity is essential, and extreme care should be exercised in getting the child up in a chair or on crutches If the child is being discharged from the hospital, parents should be instructed to guard the child's activity carefully against possible jars and falls Fracture of the femur has been known to occur from merely turning over in bed The fracture may

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been definitely established, that is, the treatment is known, its results are almost sure, and the risk attending it is very minor. In this day and age there is little excuse for the neglect that is still prevalent. The nurse who has an opportunity to listen to an orthopedic specialist talking to parents regarding these children will do well to observe his words, she will note, first and foremost, his insistence upon *early* treatment, but of equal importance will be his insistence on *continued* treatment. Too often these children are given prompt early treatment, and then, after they have been dismissed with an apparently satisfactory foot, the doctor's insistent demand that the child be seen at frequent intervals for several years afterward is not followed. The deformity, like most congenital deformities, tends to recur. Three or four years later the child is brought back to the clinic with a badly deformed foot for which radical treatment may be necessary. The watchword, therefore, is early treatment and prolonged observation by the specialist. One doctor made the comment that he taught the mother faithfully the care of her clubfooted son, to be carried out over a long period of years, and then when the patient was grown instructed the wife in the same fashion. This is a manifest exaggeration, but the idea is clear.

Treatment and Nursing Care

Kite Method.—Early treatment is always conservative. It varied a great deal as to manner and apparatus up to a few years ago, and to a certain degree this is still true today. The method of Kite, who believes that as high as 90 per cent of clubfeet can be treated by the conservative method up until about eight years of age, is followed to a great extent today. It is a method of gradual correction, which systematically deals with the different aspects of talipes equinovarus deformity. It is done by cast with a series of wedging maneuvers, which seek first to correct the adduction deformity of the forefoot, then the inversion deformity, and finally the equinus. From the standpoint of the nurse, the case may seem simple enough. But she should remember that each wedging is a threat to the patient's circulation. Often great care is used in watching the circulation of the extremity after the application of the original cast, but the wedging may escape notice. The doctor should see to it that the nurse is warned, and night nurses should be solicitous about inspecting the child's foot after such wedgings. Considerable strain is put on tendons, blood vessels, and ligaments after the equinus correction, which forces the plantar flexed foot into a position of dorsiflexion. Undue pain or circulatory symptoms should be reported at once.

very often be overlooked, inasmuch as the pain associated with it is attributed to the general discomfort resulting from the removal of the cast Nurses should be on the alert for any complaint which might seem to indicate that pathological fracture has occurred Any accident, however minor, should be reported to the physician at once

CLUBFOOT

In no congenital orthopedic condition is early recognition and treatment more important than in clubfoot While severe clubfoot conditions are not likely to be overlooked at delivery, a mild involvement is sometimes not noticed for periods of weeks or months Delivery room nurses and those in the obstetrical nursery should be especially observant of exaggerated attitudes in the baby's feet It is not abnormal for an infant to lie with the feet slightly inverted—that is, turned inward with the soles of the feet toward the midline of the body But the normal infant can easily assume and maintain the opposite position if slight manipulation is used A child having talipes equinovarus cannot maintain the everted position Any indication, however mild, that the baby's ability to change the position of his feet is limited should be reported at once

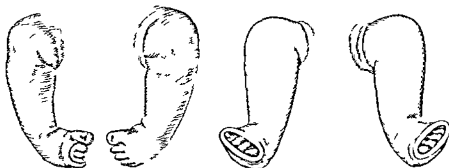


Fig 147 —Bilateral talipes equinovarus in infant. *A* Before correction *B* undergoing correction in plaster casts (From Shands Handbook of Orthopaedic Surgery The C V Mosby Company)

A few years ago considerable persuasion was sometimes necessary in order to convince parents that the baby with a clubfoot needed immediate attention Much argument was put forth against taking the baby from the breast for such treatment Public understanding is now more widespread, but the nurse will occasionally meet with parents who are extremely reluctant to begin treatment early It will be necessary to help these parents to an understanding of the necessity of very early treatment. *Clubfoot is a condition of which, one might say, control has*

that reason impracticable, whereas the adhesive can be changed for alteration in the corrective process as the need arises. A simple method of applying adhesive tape for this purpose is one given by Sever. A single narrow strip of adhesive about one inch in width is brought around the forepart of the foot from the inner to the outer aspect and is carried up the outside of the leg. The knee is kept flexed at a 90 degree angle as this is done, and the tape is brought over it and well up on the thigh. It is necessary to exert considerable traction on the tape to secure the foot in a position of overcorrection. The danger from such tape, snugly applied to the baby's skin, is, of course, immediately apparent. Adhesive plaster and the skin of young babies, as most nurses realize, do not have an affinity for each other. It is extremely urgent that the edges of the adhesive be carefuly watched for signs of skin erosion and that the danger of circulatory impairment to the foot be ever foremost in the nurse's mind.

Manipulation Without Casting.—Mild clubfoot deformity in the very young infant is sometimes treated by frequent manipulations without the use of a corrective cast. Manipulations are usually begun immediately after birth and are carried out every four hours, preferably before the baby is fed. Since the manipulation is accompanied by some discomfort for the baby, it is better to perform the treatment before rather than after the feeding; the baby soon learns to expect unpleasantness following the feeding and will cease to take his feeding well. These manipulations may be continued until the child is two, or until the surgeon feels satisfied that reduction is complete and unremittent. Frequently, however, this treatment is employed to lead up to later treatment by cast or splint.

Since there are many variations in the manner of doing such manipulations, the nurse should have demonstrations given her by the surgeon for each individual patient upon whom she must carry out such treatment. Occasionally the surgeon may feel that a complete reduction should be sought in the first manipulation and will usually demonstrate this himself. Complete reduction is considered accomplished when the foot has been forcibly brought into full calcaneovalgus to such a degree that the little toe touches the outer side of the leg. British authorities feel that this drastic early manipulation saves the child much discomfort in the long run.

It is important that the nurse understand that while she forces the clubfoot into the position of overcorrection by whatever method the surgeon prefers, she must grasp the foot below the tibial epiphysis. There is actual danger that the epiphysis may be displaced by too vigorous

Manipulation and Casting of Clubfoot—Sometimes the baby's feet are treated by a series of corrective casts applied *after forcible manipulation* under anesthesia Frequent changes of the cast are required in this type of treatment

The very young baby in the plaster cast should always have close attention The danger of circulatory impairment is so important that it *seems as though it should never be overlooked, but in the midst of a* busy orthopedic ward, where spinal and hip operations are so urgent in their demands upon nursing time, the clubfoot baby is sometimes given less attention than he deserves The foot should be inspected frequently All the toes should be visible This is frequently a point that must be *called to the doctor's attention so that more of the cast can be cut out* to reach the two small toes The cast is usually applied in a position of knee flexion, which will prevent its slipping downward, a complication which used to be common when the cast was applied only to the knee In certain emergencies, where circulatory disturbance is manifest and *severe and where no doctor is available, the nurse may be required to* cut the cast Bivalving the cast is usually preferred Most doctors advise against cutting windows over the dorsum of the foot to relieve circulation, but in other clinics this is a routine measure to prevent pressure over the dorsalis pedis artery The bandages under the cast must also be *released in case of severe circulatory embarrassment* The removed portion of plaster should be taped lightly over the opening to prevent window edema

The parent is warned about the necessity for keeping close watch on circulation when he takes the infant in the clubfoot cast away from the clinic *He is advised also to watch for signs that the child is outgrowing* his cast and to report to the clinic any severe chafing of the skin Some type of waterproofing should be applied around the thigh edge of the cast These edges must be carefully smoothed off and taped to avoid chafing the soft skin of the thigh Failure to waterproof this portion *of the cast lessens its life considerably, as a diapered child is sure* to wet the cast each time he voids In an older child, the parent must be warned that if *the foot part of the cast gets soft and thin from wear,* much of the correction so far attained may be lost It is not unusual at all to have these children return to the clinic with the cast no thicker *than a stocking and having about as much corrective force*

Adhesive Strapping of Clubfoot—Some surgeons use adhesive plaster strapping to obtain gradual correction of the clubfoot condition in infants They believe that plaster of Paris is outgrown quickly and for

that reason impracticable, whereas the adhesive can be changed for alteration in the corrective process as the need arises A simple method of applying adhesive tape for this purpose is one given by Sever A single narrow strip of adhesive about one inch in width is brought around the forepart of the foot from the inner to the outer aspect and is carried up the outside of the leg The knee is kept flexed at a 90 degree angle as this is done, and the tape is brought over it and well up on the thigh It is necessary to exert considerable traction on the tape to secure the foot in a position of overcorrection The danger from such tape, snugly applied to the baby's skin, is, of course, immediately apparent Adhesive plaster and the skin of young babies, as most nurses realize, do not have an affinity for each other It is extremely urgent that the edges of the adhesive be carefuly watched for signs of skin erosion and that the danger of circulatory impairment to the foot be ever foremost in the nurse's mind

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It is important that the nurse understand that while she forces the clubfoot into the position of overcorrection by whatever method the surgeon prefers, she must grasp the foot below the tibial epiphysis There is actual danger that the epiphysis may be displaced by too vigorous

manipulation. This can be easily avoided by being sure that your hand grasps the foot well below the malleoli, while with the other the ankle is held rigid and stable.

Braces and Shoe Corrections.—Some type of short leg brace may be ordered after plaster is removed, and this is worn both during the day and at night until the doctor gives the parent instructions to discard it. Exercises may be prescribed by the physician and demonstrated to the parent at this time. Experience has shown that follow up exercises are a most neglected feature of home care. When quizzed upon return visits to the clinic, parents frequently admit that they have omitted them for one reason or another. These exercises, however, are important, they are not difficult to perform, and parents should be urged to continue them faithfully for the welfare of the child. Failure to carry out such orders may mean that the parent has no very clear conception of the importance of the exercises, and a little time given to explanation will pay surprising dividends.





Fig. 148. Fig. 149.

Figs. 148, 149.—Orr clubfoot brace with valgus strap. (Courtesy Arthur Steindler.)

Fig. 148.—Metal upright bent at its distal end perpendicular to the upright.

Fig. 149.—The brace is incorporated into the heel of the shoe and stabilized by use of a calf band.

Shoe corrections may consist of an elevation to the outer border of the sole and heel. This will throw the foot into a slightly everted position and aid in the maintenance of overcorrection. Here again, the par

ent must be warned that when these corrections are worn down, the child should be brought to the clinic It is disheartening to observe children returning to the clinic in run over heels and worn down shoe corrections after a long and costly series of treatments at the hands of the orthopedist Doubtless fuller instructions given to the parent by doctor and nurse would obviate much of this carelessness

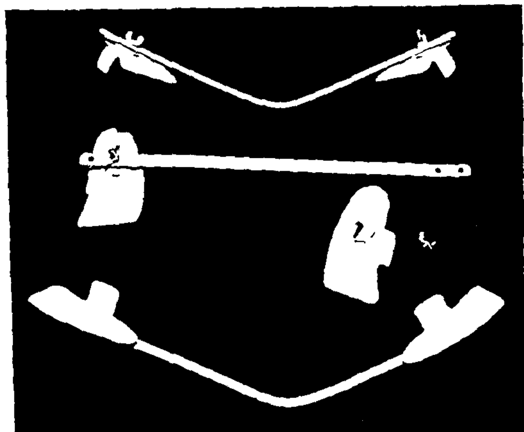


Fig 150 —Details of construction of Denis Browne splints (Courtesy Arthur Steindler)

Clubfoot braces have a bar on the medial aspect of the leg and a foot plate or caliper for the foot There is also a lock at the ankle to prevent plantar flexion In applying the footplate hold it securely onto the foot with one hand The strap at the back of the heel is fastened to the first buckle close to the toes The second foot strap is fastened then to the last leg strap The footplate is always placed in position before the leg bar is secured by its strap at the top as this aids in obtaining a position of abduction and eversion as the bar is swung back and fastened to the leg Foot straps should be applied snugly although the leg strap need not be quite so tight On an infant occasionally a strip of adhesive ending in

a webbing strap is applied to the medial aspect of the calf This is to be fastened into the extra buckle on the clubfoot brace near the inner aspect of the heel and is for the purpose of maintaining the heel snugly against the footplate Nurses should understand how to apply these braces accurately They are of worse than no value if improperly applied, particularly if the heel is allowed to ride upward from the footplate the original equinus deformity may be exaggerated rather than corrected Braces are used only to *maintain* correction, they will in themselves never *correct* a clubfoot deformity Parents should have a clear understanding of this fact

The Denis Browne Splint —The Denis Browne splint has proved a useful device for the treatment of clubfoot in young children The splint *works on the mechanical principle that it is possible to correct the position of one foot by means of the other* In this treatment the muscles of the leg and foot may be used and strengthened while the deformity is being corrected, thereby eliminating some of the atrophy and joint stiffness which often occur when casts are used for correction Many modifications of the original splint have been made, but the general principle remains the same The splint is composed of a flexible horizontal bar attached to a pair of footplates There is a device under the plates to allow for rotation of the footplate on the horizontal bar The apparatus is constructed so that each footplate is manipulated by means of the other Various methods of securing the splints to the feet are used Bandages, tape, and even plaster of Paris have been tried Adhesive tape is probably the most commonly used method in this country at present Sponge rubber or felt is used to cover the footplates on the surface contacting the foot

While the technique of strapping the foot to the plate varies somewhat in different clinics, certain principles must be observed to assure success in the treatment

1 The skin of the foot must be inspected carefully to see that it is clean and free from abrasions For the original strapping it is prepared by washing and drying and may sometimes be painted with tincture of benzoin For subsequent strapping, however, most surgeons prefer that the skin be left as it is, and washing or cleaning of the area with benzine or other solvents is not done

2 There should be careful apposition of the foot to the footplate The heel and sole must be firmly held to the plate the sidepiece should contact the infant's ankle

3 In applying the tape, care must be taken to see that no wrinkles occur in the tape, which might be the cause of pressure areas beneath

4 There should be no open spaces between the strips of tape or window edema may occur

Some physicians feel that it is wise to begin the treatment by attaching the feet to the plate for a short time in the position of the deformity, rather than to attempt immediate correction The bar is bent in the shape of an inverted V and applied to the footplates in such fashion that *the position of the feet is not changed* Swelling and skin irritation may sometimes be reduced and pliability of the foot encouraged by this method

During the period of correction, which may take from six to eight weeks, strapping is changed frequently, usually every five or six days The child is allowed to leave the hospital only when there is absolute assurance that the parents will see to it that he is returned promptly for change of strapping It is usually considered preferable to keep the child in the hospital during the first period of treatment, that is, until correction has been obtained

After one or two strappings, the connecting bar may be straightened to the horizontal position The feet will follow the position of the bar and the adduction and inversion of the feet will gradually be corrected until a neutral position is obtained, that is, the feet will point straight ahead After that, effort is made to rotate and abduct the feet until they reach 90 degrees of outward rotation, which is the position of overcorrection essential in the treatment of clubfeet

In order to secure a valgus position, some orthopedists prefer to angulate the bar into a true V shape at the time the foot has reached the neutral position

As treatment proceeds, effort is made to stretch the calf muscles This may be done by increasing the V angle of the bar while the foot is in 90 degrees of outward rotation If the deformity is unilateral, the bar on the normal side is bent horizontally so that the normal foot is held in physiological position at all times

The more vigorous the baby's activity, the greater will be the correction, for as the child flexes one leg and extends the other, the foot on the flexed side is forced into a valgus position, which, of course, is the corrected position for varus deformity Furthermore, with the foot in the valgus position, flexion of the knee will cause the foot to go into dorsiflexion, thereby putting the posterior calf muscles on a stretch This is necessary for correcting the equinus deformity It can readily be seen that with this treatment the baby himself provides his own corrective manipulation by his normal activity Five or six weeks of this activity may be sufficient to obtain correction, but *maintenance of correction*

will require a far greater length of time The splint may be used as described for five or six months, after which shoes may be attached to the plates Usually the shoes will be attached in reverse, that is, the left shoe will be used for the right foot and the right shoe for the left foot This apparatus may need to be worn six months or longer After the child comes to the walking age, alterations are frequently applied to the walking shoe An outside wedge or patch of leather, $\frac{3}{16}$ inch in thickness, may be placed on the sole This alteration aids in overcoming any tendency the child may still have toward adduction or varus The physician sometimes prefers that the child wear a shoe without a heel in order to continue stretching the tendon of Achilles The night splint is usually continued for a year or longer even after the child begins to walk

Pediatricians have sometimes commented upon the increased likelihood of upper respiratory infections in children who are having club foot correction by the Denis Browne splint method as compared with those whose treatment is by cast There seems to be some relationship to the fact that nurses tend to pick up babies in clubfoot casts more frequently, and that babies in splints are often left in their cribs during the entire day, for bathing, dressing, and even feedings Nurses are urged to see that these babies are taken from their beds frequently and either held or placed in chairs for at least part of the day The well being of the baby may depend a great deal upon this simple factor

It cannot be overemphasized that the skin of babies upon whom adhesive is being used for any reason must be carefully watched for signs of swelling excoriation or blueness Any abnormality of the skin around the tape should be reported to the physician immediately

When the child is discharged in the Denis Browne splint, some physicians instruct the parents to remove the plates from the bar once or twice daily They feel that this will aid in preventing pressure areas The parents are also instructed to check the position of the baby's heel at frequent intervals If the heel is found to be slipping up, the *instructions* usually are to remove the foot from the plate and to return the child to the clinic at once

Parents are sometimes asked to place a crossbar above the baby's crib and to attach the bar of the splint to this for part of the time It is felt that this will aid in eliminating the equinus position which results from constant resting on the bed Instructions to parents should of course include advice to keep the baby in the sitting position at intervals during the day

Treatment of the Older Child—The older child with recurrent or neglected clubfoot will usually require some type of surgery. It is never possible to reconstruct the foot to perfect contour and function by surgery, but a good weight bearing foot that will minimize the deformity can usually be obtained. In order to eliminate chances of disappointment following surgery, the parents and the patient should be given a realistic understanding of just what the operation will do. Only careful explanation of the expected result *before* the operation is done will prevent this disappointment.

Soft tissue procedures, such as tendon lengthenings, stripping of the plantar fascia, or capsulotomies are often done for neglected clubfoot. Surgery on the bone may be required for maximal correction in some cases. These may be wedge resections, osteotomies, or astragalectomies.

On a busy orthopedic ward where major surgery is being done daily, these patients may seem of only minor importance. But they are not minor cases, and the danger of congestion and hemorrhage is great. They will usually be immobilized in a cast which extends to the thigh and which will be kept elevated with pillows or a hammock.

The nurse should be on the alert for seepage of blood at the site of surgery and also at the thigh where the cast ends, since frequently hemorrhage may be detected there. An overhead frame with a hammock to support the cast is the method of choice in supporting the leg. Pillows may be used, but are not so stable, and many pillows are necessary to obtain a comfortable degree of elevation. The patient is usually much more comfortable in this position, and it does not interfere with nursing care, as he can be moved from side to side as long as *elevation* is maintained. This is usually maintained about forty eight hours, longer if congestion or pain is excessive. The nurse needs to heed complaints of the patient and to interpret them intelligently. She needs to know where the line of incision is, that she may be on the alert for odor. She needs to know this, also, in order to detect pain at other points which should not be present. A complaint of pain at the heel, the patella, or the dorsum of the foot is not an expected aftermath of such surgery and should be reported at once. When the surgeon has given an order to have the cast cut over any of these points, the cutting should be done at once, not at the end of the day when it is easier to secure an orderly. Too often casts may be marked for cutting in the morning or early afternoon, but the actual process may be delayed for hours if the nurse is not faithful (and persistent) in her attempts to get a cast cutter to the bedside.

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tissues on the deformed side will become adaptively shortened, and this will be followed by certain definite bony deformities in accordance with Wolff's law *

The nurse caring for a young baby should be alert to detect any signs of limitation of movement in the head or neck Frequently when the stage of tumor and tenderness is missed, the deformity may escape notice because there are no very marked symptoms except this limitation

Treatment and Nursing Care —In mild cases, after the stage of tumor and tenderness has passed, manipulation and exercises are usually instituted, and often these alone will suffice to overcome the deformity These manipulations should be prescribed and demonstrated to the nurse by the surgeon for each patient, and progress should be checked frequently by the surgeon to insure proper results from the treatment

If the manipulative treatment fails, or if the child is not seen until he is two years old or over, surgery is usually indicated In severe cases, surgery is sometimes done on the young infant, in which case one of the foremost nursing problems is to care for the baby properly in his apparatus

When the child with a torticollis is being prepared for surgery, it is necessary to shave above the hairline on the affected side When doing this preparation, get specific instructions from the surgeon as to the extent of the area he wishes to have shaved With the young girl having a tenotomy of the sternocleidomastoid tendon, it is possible to part the hair low on the affected side, comb it to the opposite side, and braid it tightly Postoperatively the patient is especially happy to have this long hair to comb over the shaved area

Casts are not always applied immediately after surgery Postoperative nausea and the possibility of respiratory embarrassment make it somewhat safer to apply the cast the following day Some type of retentive apparatus may be used in the interval If the child is under one year of age, a Bradford frame and restraint should be ready Head traction is difficult to apply and can be dangerous if it is inefficient in such a young child A flannel sling for the chin may be devised to exert head traction, but it must be inspected very frequently lest it slip and impair the child's breathing or smother him by slipping upward The sling or chinpiece is usually made of flannel in a strip whose length depends somewhat upon the size of the child—eighteen to twenty seven inches is

* Wolff's Law Every change in the form and the function of bones or in their function alone is followed by certain definite changes in their internal architecture and equally definite changes in the external conformation in accordance with mathematical laws Julius Wolff 1868 Briefly the Law may be remembered as *Form Follows Function*

Dressing cart technique should be rigidly aseptic when the cast is cut and the first dressing done. Frequently if stitches are removed too soon, spreading of the incision may occur. The surgeon will usually ask for some type of "bridge" adhesive strap to assist him in approximating the wound edges. Adhesive "bridges" used for this purpose should be carefully flamed with a match and then painted with a strong disinfectant and allowed to dry before they are applied.

The three principal causes of failure in the treatment of clubfeet have been listed as (1) delay in beginning treatment, (2) imperfect nerve supply to muscles, as in conditions such as spina bifida, and (3) failure to obtain and maintain complete overcorrection of the deformity. Nurses will easily recognize their part in helping to eliminate at least two of these causes of failure—the delay in beginning treatment, and the failure to continue medical supervision after correction has been obtained. Parents should be guided to the realization that follow-up treatment in clubfoot is fully as important as the active correction and must have a clear understanding of their responsibility in this matter.

TORTICOLLIS

In torticollis, also, early recognition and treatment are essential. It is now generally recognized that much facial and postural deformity can be prevented if conservative treatment is begun early. The deformity may at birth be so mild that it is unobserved, or, being observed the opinion may be held that with function the child will outgrow it. However, as time goes on the ligaments on the affected side become so shortened and twisted that facial deformity becomes pronounced. Very early in the child's life an elongated swelling may be noted in the lower half of the sternocleidomastoid muscle. It is quite tender at this time, and the child will cry if it is touched, or if the neck is stretched. This swelling and tenderness will leave and the mother usually decides that there is nothing further to fear. Somewhat later, however, it can be observed that muscle tenseness exists, because a band of fibrous connective tissue has developed which, by contraction, pulls the head into the characteristic attitude—the ear on that side seems to be pulled downward toward the clavicular side, and the face itself is turned in the opposite direction. When this condition is left without treatment, a slowly developing atrophy of the side of the face near the affected muscle will come about, and this will become very apparent as the child grows older. This is, of course, followed by tissue changes. The soft

After the cast is dry, the scalp section will usually be cut out to permit care of the head, and constant attention to this area will be necessary to prevent itching and irritation from plaster crumbs At feeding time it will be necessary to protect the cast well with towel or napkin to prevent food from falling down inside The ears must be inspected frequently to see that no plaster crumbs or pieces of food are lodged in them Scalp and ears both tend to become sore easily when this type of cast is worn These patients are soon ambulatory and are often left to care for themselves, but it must be remembered that careful supervision will be necessary daily to detect signs of skin irritation, pressure areas, or cracking and softening of the cast

The cast may be kept on from six weeks to several months according to the severity of the condition After it is removed, physical therapy will be ordered, consisting of massage, manipulation, and gymnastic exercises These treatments may need to be continued over a considerable period, particularly in the older child The parents should understand that torticollis cannot be completely corrected by surgery alone, a long period of follow up care, under the constant supervision of the physician, will be necessary If the child is dismissed soon after the cast is applied, the mother will need careful instruction in the details of caring for the patient and his cast

SPINA BIFIDA

Spina bifida consists of a defect which may occur in the dorsal or lumbar region of the spine—much more frequently in the lumbar In the mild forms it may cause only structural weakness (spina bifida occulta), but in the severe forms there may be complete or partial paralysis of the legs and also of the bladder and rectum In the mild forms there may be no obvious deformity, but in the severe forms there may be a sac with a wall of tissue paper thickness varying in diameter from one to three or four inches in the newborn

Cause —It is congenital During the normal process of development in the embryo, the spinal cord is the most posterior structure, but as development takes place the cord is covered by a posterior growth of bone, muscles, and ligaments The bone growing from each side meets in the center posteriorly, forming the spinous process In spina bifida occulta the component parts of the process almost meet, but in the severe type they make little progress toward meeting and consequently the spinal cord is left exposed and nerve development to the limbs is incomplete

the usual length, and three or four inches for width In the exact center of this strip a longitudinal slit is cut, four to six inches A tuck of one inch is taken above the slit The bandage can now be applied as a halter beneath the child's chin with the tucked section inferior in position The ends of the bandage are attached to a spreader, which in turn is attached to a rope going over a pulley and on which weights are suspended The amount of weight used will be ordered by the doctor, but it is usually very little Sandbags may be used to control the position of the head

Adhesive traction is sometimes applied on older children postoperatively One strap may be placed on the cheek of the unaffected side, to pass under the chin, and thence to a rope which hangs over a pulley at the opposite side of the bed The second adhesive strap passes across the forehead and thence around the head to fasten on the side of the bed opposite the first strap Adhesive retention apparatus applied in this fashion no doubt has its advantages, but it does not make the care of the patient easy for the nurse Close observation of the skin of the face is necessary, as the adhesive tends to cut into the skin and cause denudation which may lead to superficial infection The ordinary type of Sayre chin strap may be used, augmented by sandbags to keep the head overcorrected In this type, a long sandbag is placed low, forcing the chin toward the side on which the incision has been made The second sandbag is placed on the opposite side, exerting its pressure on the forehead and ear They must be closely watched, of course, as they tend to slip

Traction of this nature may be worn for a week or two, when a brace is often applied This brace is usually one which comes well down over the spine and may be a Taylor body brace with some type of corrective chin apparatus

If the cast is applied in surgery before the patient becomes conscious, considerable care must be exercised to prevent aspiration of vomitus Suction apparatus must be available to use with this type of patient The area around the chin and mouth need to be protected with pieces of waterproofing which may be tucked in until the cast is dry enough to finish the edges An odorless material should be used which will not add to the patient's nausea (Oiled silk for instance, has an odor which is sometimes highly objectionable to patients who have had anesthetics) A towel should also be tucked in around the face to further eliminate soiling

After the cast is dry, the scalp section will usually be cut out to permit care of the head, and constant attention to this area will be necessary to prevent itching and irritation from plaster crumbs At feeding time it will be necessary to protect the cast well with towel or napkin to prevent food from falling down inside The ears must be inspected frequently to see that no plaster crumbs or pieces of food are lodged in them Scalp and ears both tend to become sore easily when this type of cast is worn These patients are soon ambulatory and are often left to care for themselves, but it must be remembered that careful supervision will be necessary daily to detect signs of skin irritation, pressure areas, or cracking and softening of the cast

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Treatment —Although immediate surgery with an attempt to force closure of the spinal canal was previously advocated, recently the inclination has been to delay surgery and possibly to omit it entirely

Prognosis —The future of children with spina bifida is always questionable They may develop water on the brain (hydrocephalus) and become imbeciles, or they may go on to the stage of school life and adult life greatly disabled by the weakness or paralysis in their legs and by the absence of control of the bladder and bowels, causing continual embarrassment to them in their contacts throughout school and adult life Braces for the legs or stabilization operations often help locomotion

The Nursing Care —The infant with spina bifida manifesta is not usually seen first on the orthopedic service, as such conditions are considered in that early stage to be primarily pediatric and neurological in nature However, their congenital malformations are sometimes multiple, or, if deformity has not been present at birth, tendency toward this in later years is considerable, and such individuals frequently spend much time on the orthopedic services of hospitals The patient with milder type of bifida (occulta), who displays but little outward manifestation of the vertebral cleft, may be admitted to the service because of clubfeet or other deformities, but on the whole this latter type of patient does not present anything very troublesome in the way of nursing problems It is the bifida patient with sensory and motor involvement from some degree of cord destruction who will be discussed here

All the problems of nursing care encountered in the patient who has such destruction of the cord through disease, tumor, or trauma, accompanied by the inevitable group of symptoms engendered by this condition, are present in the paralyzed spina bifida patient Trophic ulcers are a tremendous problem complicated as they are by incontinence of bowel and bladder Trophic ulcers have all the menacing features common to the pressure area but, in addition the patient lacks sensation, and he is completely unaware of the condition so that no warning signals of pain are given out Furthermore, lack of nutrition to the area, which is caused by impairment of the sensory nerves supplying the muscle and blood vessel in the part, makes healing difficult or impossible Nurses should remember that in trophic ulcers the blood vessels surrounding the area have become dilated through failure of the nerve supply which normally regulates blood flow and that because of this the blood tends to stagnate, causing the surrounding tissues to become ischemic

The tendency to deformity in these patients is so great that frequently children are admitted to the orthopedic wards with hips and knees

flexed to a right angle, back extremely rounded, feet inverted to such an extent that the appearance is one of clubfoot, although this is found to have developed subsequently to birth Dislocation of the hips is not uncommon, and hydrocephalus frequently adds to the dismaying picture

The spina bifida patient is often admitted to the orthopedic ward for such correction of deformity as will enable the child to walk with the aid of crutches and braces Sometimes the immediate cause of his admission may be the grave nature of the trophic ulcers which have baffled the parent's attempts at healing

Surgery may be done for correction of any of the existing deformities A particularly troublesome deformity is the flexion contracture of the hips The Soutter operation may be done for this condition It consists of stripping of the contracted flexor muscles about the hip from their origin on the ilium so that complete extension of the thigh is possible Aftertreatment is especially important A bed position which permits of extension of the hips, obtained either by the Schwartz or Whitman frame, or by the use of a double hip spica cast, is necessary—the purpose of either being to obtain further extension of the hips, or at least to maintain that extension which was obtained at operation Sometimes the body section of the cast is applied, along with disconnected long leg casts, but the two are left separate until such further extension as can be obtained by position in bed has been brought about Whether cast or frame is used, in the presence of sensory paralysis the nurse will quickly appreciate the problems involved Prevention of trophic ulcers, which come about with lightninglike speed, sometimes within twenty four hours, is the grave problem which confronts the nurse Prevention of cast soiling is secondary, but it, too, is extremely important

Instruction should be sought early from the surgeon in regard to management of these patients He will realize how serious a problem confronts the nurse and will be able to assist her in planning safe alterations of position Frequent changes to the prone lying position must be such as will maintain the extension of the hips The patient is pulled to the side of the bed, rubber covered pillows are placed in the area where legs and thighs will fall, and he is turned from the frame into a hyperextended position The back, buttocks, and groin must have attention many times a day, certainly as often as the child becomes wet Wrinkled, compressed, and bluish areas must be meticulously cared for The child s skin will reflect promptly any letup in nursing care, any wrinkles or crumbs in his bed, or neglect in changing position

If the patient lies on a frame, a bedpan can be kept constantly in place beneath the opening The divided frame must be protected with rubberized material covered with diapers to obviate having to change it frequently during the day Indwelling catheters and tidal drainage are not often employed for these patients

If a cast is used, the care of it is complicated It is an extremely difficult task, particularly with girl patients, to avoid a soggy evil smell ing cast Very early attention to waterproofing the entire cast, as well as to protecting its edges generously with a durable waterproof material, is the first step A divided Bradford frame may be used, with the bed pan constantly in place Elevating the head of the bed on blocks will help to defeat the part gravity will play in drawing secretions up under the cast

Any apparatus must be considered a menace to the skin of patients with this condition Vigilant eyes, fingers, and nose cannot be empha sized too strongly here Remember the patient cannot tell you where the pressure is, you yourself must supply this missing sensation by care ful frequent inspection of the parts in apparatus

Soap and water cleanliness, followed by a dusting powder (borated), freedom from pressure, moisture, and irritating creases in bed are essen tial in the care of perineum and buttocks Frequently the most resistant areas of ulceration occur in the groin as fissures, or beneath the gluteal folds as large deep seated sores

Steindler states that following the Soutter operation, certain symptoms may indicate that correction has been forced too far abdominal pain and tension on the femoral artery which produces sudden and very grave circulatory disturbances in foot and leg He also states that acute stretching of the femoral nerve may be the exciting cause of a reflex irritation, which may manifest itself in convulsions Any of the above symptoms should be of significance to the nurse as she cares for the newly operated spina bifida patient who has had correction of flexion contractures of the hip

The nurse should expect the patient to have considerable acute dis comfort after such surgery Gentle handling and great patience are necessary in his care

Frequently no more pathetic individual exists on the orthopedic ward or in the crippled children s school than this type of patient He often feels himself to be an outcast because of his inability to take care of his toilet needs He has besides the motor disability which limits him in so many ways, the social difficulty so much harder to bear as he goes

into adulthood Sometimes his hydrocephalic appearance gives him a look of subnormal intelligence which is not indicative of his actual mental capacity

Long leg braces with a pelvic band or girdle are usually prescribed when the child is ready for walking These, too, must be considered a threat to the integrity of the patient's skin, and the child's body must be carefully inspected for signs of irritation when they are removed It is not usually considered advisable for such patients to remain in these braces for the entire day Periods of bedrest without braces but in good body alignment should alternate with hours of ambulatory exercise The problem of keeping the patient dry when he is in his braces can be solved by the use of a rubber urinal or by waterproof pants over thick layers of diaper cloth It is difficult to purchase waterproof pants large enough for older children, but these can be made quite simply from oiled rayon or oiled silk, the edges bound with some type of cloth for better wear They are best made so that they are opened at the sides as well as the top, as it is easier to apply them over braces in this fashion Tape ties can be sewn to the binding, and these may be tied on the outer aspect of the thigh and hip to secure the garment

Parents frequently bring in these children, who have never walked, begging the physician to enable the child to walk They are grateful when this is accomplished, as it frequently is but they will not recognize their own part in continuing this progress if they are not permitted to watch the meticulous nursing care that accompanies the physical rehabilitation of the child The complications which may ensue because of pressure of braces on legs must be pointed out The necessity for preventing recurrence of deformity by watching the child's bed, chair, and walking posture, as well as by the faithful use of such night splints as have been ordered by the surgeon, should be emphasized Especially must the care of the skin around the buttocks and groin be demonstrated The parent must be urged to assist the child to develop as much self dependence as he is capable of assuming

QUESTIONS FOR STUDY—UNIT III

1 How will a sound knowledge and understanding of the normal infant assist the nurse in providing better care for children with congenital anomalies?

2 What routine inspection might the nurse be expected to give the newborn during the initial bath?

3 What nursing problems will confront the mother caring for her child in a hip spica cast? What can the nurse do to help the mother give good nursing care to the child?

4 Why is it important that the following conditions be diagnosed and treated early

a Congenital dislocated hip?

b Torticollis?

c Clubfeet?

5 What symptoms may be observed which would indicate a congenital dislocated hip

a Before weight bearing?

b After weight bearing?

6 At what sites would you be particularly alert for pressure areas after wedging of a clubfoot cast?

7 Discuss overcorrection as a means of treatment in congenital deformities

8 List two types of spina bifida and describe each

9 Be prepared to discuss the nursing care of the patient with a spina bifida as related to the following

a Prevention and healing of trophic ulcers

b Prevention of deformities and secondary contractures

c Care of incontinence

d Problems of the spina bifida patient with braces

e Problems encountered following surgery

f Psychological, social and economical factors

g Providing adequate home instruction and follow up care

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Unit IV
DEVELOPMENTAL DISEASES OF BONE

Chapter 10
DEVELOPMENTAL DISEASES OF BONE

A number of affections of bones and joints occur in middle childhood and adolescence with such regularity in age incidence that they seemingly are related to epiphyseal bone growth Many of these conditions are self limited within set time intervals and need treatment only to prevent deformity while the condition runs its cycle Some are capable of inciting pain and therefore demand treatment The more common of these conditions will be discussed in this chapter

COXA PLANA

(LEGG'S DISEASE, LEGG PERTHES' DISEASE, OSTEOCHONDRITIS DEFORMANS JUVENILIS, COXA PLANA)

This is one of the conditions which used to be frequently confused with tuberculosis of the hip, since the early symptoms are almost identical Osteochondritis of the hip is a self limited disease occurring usually in children between five and ten years of age Boys are more frequently affected, suggesting possibly trauma as one of the instigating causes Muscle spasm is rarely severe and motions are usually restricted only in abduction and rotation, as contrasted with tuberculosis or arthritis where all motions are restricted

Pathology —The x rays show at first small vacuoles on either or both sides of the epiphysis Following this, during the course of a few months to one or two years, the head of the femur undergoes degenerative changes in which segmentation first takes place This is combined with liquefaction over the cartilaginous surface of the joint and flattening of the upper surface of the head of the femur In two or three years, when healing finally occurs *automatically* the epiphyseal line becomes more horizontal and there is flattening of the head of the femur

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Williams Barbara Talipes Equinovarus—Nursing Care in the Hospital American Journal of Nursing 51 710 711 Dec , 1951

prevalent in boys than in girls and frequently is bilateral Trauma may play an important part in the precipitation of displacement and symptoms, but undoubtedly there is some underlying deficiency in calcium metabolism and perhaps a deficiency in the function of the thyroid and pituitary glands

Pathology —There are three stages to the disease (1) In the preslipped stage the condition manifests itself by the presence of a slight limp to the affected side and a slight limitation of internal rotation of the hip X ray pictures in the preslipped stage show little or no displacement but a slight rarefaction of bone on the lower femoral side of the epiphysis (2) Through trauma or some minor injury during the earlier stages of slipping the femoral portion of the epiphysis may slide further upward and further eversion may occur (3) More extensive slipping of the epiphysis upward with increased eversion of the limb occurs in the more severe or later stages The bony changes shown by x ray are accompanied by increased limitation of abduction and internal rotation When such a degree of displacement exists, there is a rather marked limp but pain is not a prominent symptom

The condition usually appears during the rapidly growing stages between the ages of twelve and fifteen years

Diagnosis —The symptoms and signs present would, if seen in a child of from seven to ten years of age, be similar to those shown in Legg-Perthes' disease, but the age of the patient alone suggests further investigation The x ray findings are quite characteristic There is an active epiphyseal line below which the bone seems to flow into its deformity The neck of the femur assumes a horse neck" appearance

Treatment —

1 The only treatment during the preslipped stage is immediate internal fixation to prevent possible future slipping

2 Where definite slipping has occurred within a few weeks before observation, manipulation may be done by the method of Whitman or Leadbetter The leg is brought into forced abduction and internal rotation under anesthesia When reposition of the fragments is established, the foot will no longer evert when the heel is rested on the palm of the hand A cast is applied with the leg in abduction and internal rotation Nailing with a Smith Petersen nail is sometimes recommended Other operative procedures are also used

This phenomenon does not usually lead to much interference with joint function in early years but may lead to irritative changes about the hip joint later in life because of the discrepancies in shape between the head of the femur and the acetabulum

Treatment—It is somewhat doubtful whether any treatment has much influence on the eventual outcome of the disease or on the maintenance of the contour in the shape of the head of the femur Some investigators recommend complete rest and traction during the developmental stages If begun early this type of treatment gives the best restoration of the normal shape of the head Some (Paul Steele) recommend operation with replacement of the liquefied areas under the head with small bone graft chips from the neck of the femur, some recommend braces to relieve weight bearing, and some recommend the drilling of holes through the neck of the femur into the head to stimulate bone growth Others recommend treatment in two long leg casts fastened together in abduction

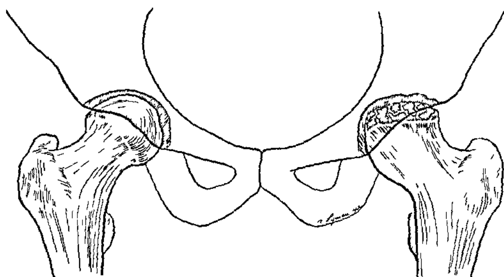


Fig 151—Legg Perthes disease The epiphysis of the left hip is in the middle stage with extensive segmentation

SLIPPED FEMORAL EPIPHYSIS

Cause—The condition occurs in two types of adolescent individuals (1) the fat overgrown type (Frohlich's syndrome) and (2) the rapidly growing slender type of individual The condition is somewhat more

Epiphysitis of the Tibial Tubercle

(Osgood Schlatter's Disease, Epiphysitis of the Tibial Tubercle)

This condition usually occurs in rapidly growing children, most frequently boys between ten and fourteen years of age They complain of pain at the attachment of the patella tendon on going up and down stairs, and of rather acute tenderness and swelling in this region X-ray may show a small beadlike piece of degenerated bone under the epiphysis of the tibial tubercle

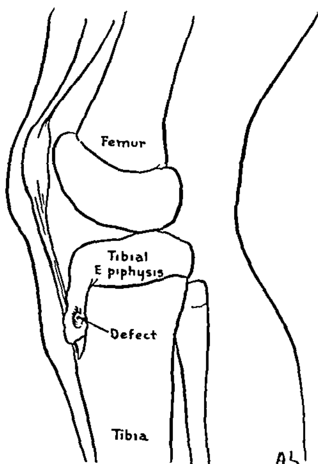


Fig 153 —Osgood Schlatter s disease Epiphysitis of the tibial tubercle

Treatment—Mild cases usually respond to protection by a cast or a re enforced elastic knee support In severe cases, operative removal of the small piece of degenerated bone may be necessary

3 In cases where displacement has existed for months, an operation is necessary to restore alignment and improve joint function This is accomplished by various types of osteotomy through the neck or trochanteric region of the femur

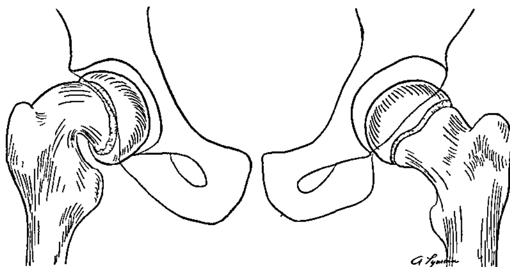


Fig 152 —Slipped femoral epiphysis of the right hip Note the horse neck appearance of the neck of the femur and the erect position of the epiphyseal line

EPIPHYSITIS

Epiphysitis of Spine (Scheuermann's Disease, Juvenile Kyphosis)

As a result of injury which usually consists in forcible acute flexion in a moderately young individual, there may be trauma to the anterior joint margin of one of the vertebrae The lumbar vertebrae are the most susceptible Following this, a small area of bone may be deprived of its normal circulation and undergo degenerative changes Gradually it loses its contact with the rest of the vertebrae and becomes encysted

Symptoms —These are usually mild and consist in a slight amount of pain on certain motions and possibly an intermittent dull aching sensation in the spine The x ray picture shows characteristic separation of this fragment with the increased density of necrosis and a surrounding area of liquefaction

Treatment —Immobilization in a hyperextension plaster of Paris body cast from two to three months, followed by a Taylor back brace will usually lead either to the healing of the process or to the formation of a bridge of bone between the bodies of the adjoining involved vertebrae

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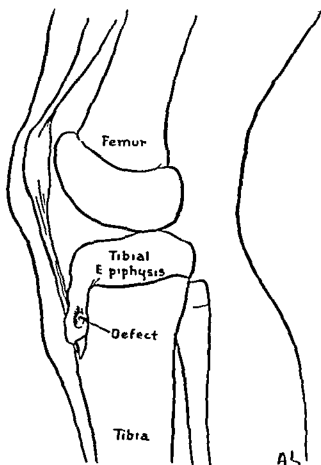


Fig 153 —Osgood Schlatter's disease Epiphysitis of the tibial tubercle

Treatment —Mild cases usually respond to protection by a cast or a re enforced elastic knee support In severe cases, operative removal of the small piece of degenerated bone may be necessary

OSTEOCHONDRITIS OF THE KNEE JOINT

Although osteochondritis may occur in almost any joint in the body it is comparatively common in the knee It usually appears under the cartilage of the outer surface of the inner condyle of the knee joint



Fig 154 —Osteochondritis of the knee Note punched out margin on the medial condyle The loose body (joint mouse) which arose from the punched out area is visible in the quadriceps pouch along the latter shaft

Cause —The cause is usually injury in which an unusual motion or strain of the joint may occur and cause damage and local disturbance of the supply of circulation to a small area of bone and cartilage within the joint The bone becomes separated from its blood supply and undergoes degenerative changes which separate it from the rest of the bone This piece of dead bone may break through the covering of cartilage and enter the joint The protective mechanism of the joint attempts to cover this loose bone with cartilage until it finally becomes smooth and may slip from one point to another within the joint, causing lockage when it is caught between the joint surfaces

Treatment —When the presence of a joint mouse is definitely established by clinical observation and by x ray picture, it should be removed, even if its presence can be established by x ray findings before it has dislodged

SCOLIOSIS

Scoliosis is a lateral curvature of the spine It is called functional or *postural scoliosis* when there is no abnormality in the shape of the vertebrae and the patient can voluntarily correct the deformity In structural scoliosis there are changes in the shape of the vertebrae and



Fig 155 —Right thoracolumbar idiopathic scoliosis

thorax which make correction of the deformity impossible The scoliosis is described as thoracic, lumbar, and thoracolumbar according to the spinal segment involved Curvatures of the thoracic spine are very frequently convex to the right, whereas curvatures of the lumbar spine are more often convex to the left Scoliosis is usually accompanied by rotation of the vertebral bodies toward the side of the convexity of the curve

The rotation of the thoracic vertebrae causes the ribs on the convexity of the curve to protrude backward The ribs on the side of the concavity are more prominent forward In severe thoracic scoliosis the thorax is thus grossly misshapen Very often the deformity consists of a right thoracic curve associated with a left lumbar curve

Causes—Functional or postural curvatures are usually due to faulty posture, weak musculature, and weak ligaments Postural types of scoliosis rarely develop into structural types

Structural scoliosis may be caused by infantile paralysis (paralytic scoliosis) congenital deformity of the vertebrae (congenital scoliosis), diseases of the lungs, certain diseases and tumors of the spinal cord and of the ribs, neurofibromatosis, hysteria, etc The cause of the scoliosis is unknown in a very large number of cases (idiopathic scoliosis) Poor protein intake is often observed in children with idiopathic scoliosis

Symptoms—Scoliosis usually develops during the periods of spinal growth Congenital scoliosis may be detected during early childhood Paralytic scoliosis develops several months or years after asymmetrical paralysis of the trunk muscles Idiopathic scoliosis which is the most frequent type, occurs much more frequently in girls than in boys and usually has its onset at ten or twelve years of age Often the deformity increases until completion of the growth of the spine

Since scoliosis rarely causes any pain until the later stages of the disease, it is frequently unrecognized until the deformity is well established Scoliosis of the thoracic spine may be detected early by the deformity of the thorax with backward protrusion of the ribs on the side of the convexity of the curve and because the shoulder on the side of the convexity is higher Scoliosis of the lumbar spine accounts for asymmetry of the hips the hip on the side of the concavity of the curve is usually more prominent Body alignment is often poor and the thorax is deviated lateralward in relation with the pelvis The normal contour of the waistline is altered It is flat on the side of the convexity of the curve and hollow on the side of the concavity

Diagnosis—It is important in the examination, wherever there is a complaint of any form of back trouble, that the patient be properly draped The back should be completely exposed from the head to the heels The range of motion of the spine in all directions should be noted and any limitations recorded The level of the crests of the ilium should be roughly estimated by pressing the hands into the flanks over them, and accurate measurement of leg lengths should be made from the

anterior superior spine to the internal malleoli. Care should be taken that the position of both hips in relation to the pelvis is the same and that they bear the same relationship to an imaginary perpendicular line extending from the center of the cervical spine through the cleft of the buttocks and down between the ankles. The relative discrepancy in shoulder height should be measured and a plumb line should be erected from between the heels to the occiput. The line should normally pass through the crease of the buttocks. The amount of lateral deviation of the spine in its various parts should be recorded and compared from time to time during observation and treatment. The range of motion of the segments of the spine should be evaluated. It will be observed that on forward flexion the rotary deformity of the thoracic spine and the thoracic deformity are increased. An x ray picture of the entire spine taken with the patient in the standing position and in the recumbent position is of valuable assistance in the diagnosis of the type of curve and shift of body weight. Roentgenograms taken every three months will show the evolution of the curve. Many curves increase little or not at all, while others progress fast. Roentgenograms taken with the patient bending as far as possible to the right and left will give valuable information as to the correctibility of the curve in view of possible fusion.

An urgent plea is being made for the routine examination of school children for the presence of curvature of the spine as well as other deformities.

Treatment.—A well balanced diet, high in animal proteins, should be advised to every child with scoliosis. Unfortunately there is no known medical treatment to stop the progression of the deformity.

Physical exercises under the direction of a competent physical therapist are indicated to improve posture, to develop a better muscle tone and to increase the vital capacity. The patient must be taught to be conscious of posture by standing and exercising in front of a full length mirror. Great benefit may be derived from ballet and modern dancing, which should be advised if a teacher is available. By these means the shoulders may be maintained at the same level and the thorax brought into proper alignment with the pelvis. The course of the scoliosis, however, is very often not altered by exercises. Daily periods of bed rest, as advised by some orthopedic surgeons are of dubious value. Corrective plaster jackets may be advisable during periods of rapid increase of the deformity. They should be worn for several months while carrying on the same program of physical exercises. Braces are easier to wear than plaster jackets but they are less effective.

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Sometimes it is not until the child is in the period of rapid growth that occurs between the ages of twelve and sixteen that the condition becomes so evident that it can no longer be overlooked. However, as with most crippling conditions, early recognition and treatment are vitally important. Parents and the general public need to recognize the fact that the tendency to wait and see if the child will outgrow the condition is a dangerous one. This attitude may keep the child from the specialist during the very time when it would be possible to minimize the effect of the curvature. On the other hand, the feeling held by some individuals that scoliosis is a progressive condition and quite hopeless from the standpoint of treatment must be combated. The child with even a well established curvature can be greatly benefited by skillful and continued treatment.

The ultimate object of therapeutic exercise in scoliosis is realignment of the body. Effort is made to align the head, shoulders, and pelvis squarely above the feet, so that the center of gravity is directly over the center of support. Attempt must also be made to derotate the rotated vertebrae, and this is often the most troublesome feature of the treatment. Some of the exercises may be done in groups, particularly those which are aimed at mobilizing and strengthening the body as a whole. Those aimed at derotation of the vertebrae must be done individually, as they will vary according to the type of curvature the patient has.

Nurses should always remember that scoliotic patients are very easily fatigued. All periods of activity should be varied with periods of rest. This should be faithfully observed in the hospital as well as in the home. It is particularly advisable for such patients to assume rest positions for a prescribed period upon return from school. Rest positions are taught by the physical therapist, and they have as definite therapeutic value as exercise itself. Nurses should always be familiar with the rest positions which have been prescribed for their patients. The physical therapist takes the responsibility for teaching these positions, but she will not be on hand to supervise them during a great portion of the day. Much harm can be done during the period between exercises if the ambulatory scoliotic patient is allowed to slump in positions contrary to those prescribed for the maximum correction of his curvature. Encouragement from the nurse may be needed to remind the patient of this important feature of his treatment. Parents, too, will need to be reminded of this after the child has returned home. A rest position which is frequently taught is one in which the patient lies on his back, with knees flexed, feet flat on the floor (or bed) with arms outstretched, shoulders rotated

Fusion of the involved segment of the spine is advised by many surgeons when the deformity is severe. It is well not to fuse the spine until the age of thirteen or fourteen years in order not to interfere with the spinal growth. The curve is first corrected with a turnbuckle plaster jacket which includes the head and one leg. The degree of correction of the curve and the extent of the spinal fusion has been previously determined by means of bending roentgenograms. When the desired correction has been achieved, the turnbuckle plaster is completed and a window is cut in the back of the cast sufficiently large to allow operative fusion of the spine through it. If the fusion has to include more than six or seven vertebrae, the operation should be done in two stages to minimize shock. The modified Hibbs method of fusion is frequently used adding bone chips obtained from the ilium or from the bone bank. After spinal fusion the same plaster jacket is worn and the patient is at complete bed rest for at least six months to allow for complete consolidation of the bone graft.

Some of the correction obtained after spinal fusion is often lost because the grafts bend or break at the points of maximum stress. The thoracic deformity is not corrected by the operation and the vital capacity is often decreased. In idiopathic scoliosis only the severe correctible curves must be fused. Fortunately, most of the patients have mild curves which need no surgical treatment. On the other hand, spinal fusion is often indicated in paralytic scoliosis.

In some cases of severe scoliosis, the deformity has progressed to such an extent that correction is hopeless. Pain may be controlled by the use of leather or celluloid jackets. In some instances, it is necessary to remove portions of ribs when they impinge on the pelvic bones.

NURSING CARE OF THE PATIENT WITH STRUCTURAL SCOLIOSIS

Scoliosis is often discovered in curious ways, but it has usually been present a long time before it is detected. A dressmaker's comment that she cannot get a hem to hang straight because one hip seems to be higher than the other, a teacher's observation of the habitual fatigue and poor posture of a child in the classroom, a girl's complaint that one brassiere strap is always looser than the other, or a child's sleeplessness because of aching pain in the knees or in the low back—these and many similar complaints are sometimes the first hints the parent has that something is not right with his child's spine.

cal devices which are used in the treatment of scoliosis However, the Risser type of turnbuckle cast and other similar casts have rather general usage, and most nurses will need to be informed about the general features of nursing care for patients in this type of apparatus The Risser cast usually reaches from patient's chin and occiput to the knee on one side and to the hip on the other, depending upon the direction of the spinal curvature It is a thick and heavy cast and is usually applied over stockinette and felt or, in some clinics, over sponge rubber There is considerable strain on the patient during the application of this type of cast, particularly if he has been bedfast for a long period, and the nurse should be prepared to receive an exhausted patient on the ward upon his return from the plaster room At least three rubber covered pillows should be in readiness, and the bed should be warmed

After a few days, usually from three to five, the cast is cut through to the stockinette on the side of the concavity The cut is transverse and reaches from the midpoint on the anterior surface to the midpoint on the posterior surface On the side of the convexity a wedge shaped slice is removed, which makes possible the bending of the cast and the spine After this, a turnbuckle is placed on the side of the concavity and hinges are applied anteriorly and posteriorly at this side of the cast Now forcible correction of the curve is begun, and the turnbuckle is turned each day by the physician until the maximum amount of correction has been secured A series of turnbuckles are usually needed, beginning with a smaller one This is turned out as far as it will permit, and then replaced by a larger one In the course of a few days the large wedge shape opening on the one side becomes smaller, while, on the side of the turnbuckle, the opening becomes larger

The period the patient spends in this type of corrective cast is a time when nursing must be skillful and vigilant Each day alters the position of the patient in relation to the cast, and new points of pressure are bound to occur each time the turnbuckle is adjusted The procedure is a period of *forcible* correction, and when such correction is being carried out the skin will almost surely suffer if not observed closely

When the cast is cut the edges should be beveled to afford greater safety to the skin The stockinette is then slit and brought out over the edges of the cast, sealing these edges so that plaster crumbs do not fall off during the process of wedging Pressure points on ribs must be carefully and frequently explored with the fingers, and, if the pressure becomes excessive, the physician must be notified He will usually turn back the turnbuckle slightly until the pressure can be relieved Fre

outward, and elbows flexed at right angles The patient's body should be in good alignment, with head, shoulders, and pelvis in the same plane

Not infrequently, the patient is asked to carry out breathing exercises on the ward several times a day The nurse should be familiar with exercises for breathing in order to supervise them adequately The ribs should be elevated and the chest wall expanded, beginning with the lower portion of the lungs The diaphragm should be contracted (lowered) during this process When the lungs are full, the diaphragm is allowed to relax, thus starting exhalation from below The error most commonly made by the unsupervised patient is in relaxing (raising) the diaphragm in his attempt to elevate the ribs, a situation which actually diminishes breathing space The diaphragm should not come upward until the patient breathes out If the nurse will place her hands on the lower border of the ribs, she will be able to determine the position of the diaphragm during the breathing exercises

Some physicians feel that, with mobilization exercises, the spine tends to become relaxed and predisposed to further deformity For this reason traction to the chin and pelvis are frequently ordered for the periods when the child is not carrying out exercises A Bradford or Whitman frame may be used concurrently with the head and pelvic traction Lateral traction may be applied with canvas hammocks which pass around the pelvis and rib cage in opposite directions with pressure exerted according to the type of curvature

However the use of head and pelvic traction has some very definite drawbacks, since the child in such type of traction tends to raise his head with great frequency in an attempt to see about him Many children actually lie most of the day with their hands behind their heads because otherwise they cannot see what goes on It is felt that such activity often undoes a great deal of the good accomplished during therapeutic exercise, and for this reason, some physicians prefer that the traction be used only at night During the day they allow their patients to lie prone with the spine hyperextended by pillows placed in a slanting fashion under the chest and shoulders The feet are allowed to rest over the edge of the mattress This position may be used for eating, reading writing and other activities It is thought by some orthopedists that this position is not only permissible but that it may actually contribute toward arresting the vertebral rotation which the reverse position, i e, head and trunk flexion seems to favor

Corrective Appliances Used in Scoliosis—It is manifestly impossible to describe nursing care for patients in all the varied types of mechani

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Circular pieces of adhesive tape form a neat finish for cast edges These do not roll as easily as straight or square edges do The cast should be protected around the buttocks by some form of waterproof material Patients in body casts are quite helpless, and exacting care is necessary to keep them clean Oiled silk or Pliofilm may be used and tucked in smoothly beneath the cast This is secured on the outside with adhesive in such a manner that the loose ends may be slipped out from underneath the cast daily during the bath, washed with warm soapy water and dried and powdered It is then replaced under the cast edges and smoothed out carefully so that the skin will not be irritated

Caution must be exerted not to use the turnbuckles as handles with which to turn the patient They are insecurely applied at best, and will be likely to break off from the cast if this is done Since turn buckles are rather hard on bed linen, it is a good plan to cover them with a small canvas girdle This can be secured around the cast with tape ties

Two or three weeks may be required for correction of the curvature Sometimes it may be necessary to apply a new cast in order to obtain complete correction When the desired position has been obtained, the cast openings are filled in with plaster, and if the patient is to be oper ated on, a large window will be cut through the back of the cast to provide an unobstructed operative area

Nursing Care After Spinal Fusion —Care of patients after spinal fusion has been discussed in another chapter and does not need to be repeated here It may be of interest, however, to mention that most surgeons fuse the patient in the cast in which the correction has been obtained, since they fear to lose correction by a change of cast If the patient has been in his cast for several weeks, the nurse is usually some what appalled at the thought of caring for him, after surgery, in the same cast A change of stockinette can be accomplished and this is a source of great comfort to the patient To do this, use a piece of stockinette sufficiently large to slip over the patient's head, and long enough to go well down over the shoulders to the point where the cast is divided for wedging Several rolls of plaster, two or three inches in width a basin with warm water, and some kind of blunt forceps are necessary It is well to protect the floor around the bed with newspapers

The new stockinette may be applied over the old, but it is advisable to remove it if this can be done conveniently, since two thicknesses of

quent rubs and occasionally some slight padding may be used to allay discomfort *Too generous use of padding will increase the bulk of the cast and thereby increase, rather than decrease, the pressure on the patient* In the Minerva type of distraction jacket, great pressure occurs



Fig 106 —Turnbuckle cast with petal finish of adhesive circles

on the chin, and this must be watched assiduously, for pressure areas at this point occur with great rapidity and leave unsightly scars *Any complaint of a patient in any type of corrective body jacket should be given prompt consideration by the nurse*

about twelve weeks, although this will, of course, be subject to verification by x-ray If a tibial graft is taken, considerable care in the handling of the limb should be used until eight weeks have elapsed

Nursing Care of Patients in Body Brace—If the patient is to be immobilized by way of a brace, the nurse should remember that a body brace of any type should be fitted snugly about the pelvis in such fashion that the lower band grasps the crests of the ilia It should be laced or buckled from the bottom as the patient lies in bed Braces should not be applied directly to the skin, but rather over a thin washable snug fitting shirt of some type Saddle soap used sparingly with a little water will keep them soft and pliable and in good condition Naphtha will remove stains When hinges are oiled, be sure no excess oil remains to soil the leather parts or to catch lint The laces should be in good condition, *without knots,* or, if straps and buckles are used, care should be taken to have frayed straps replaced at necessary intervals

If the Taylor body brace is used, the metal and leather section of the apparatus is unbuckled and lifted from the patient's body as he lies prone, the canvas apron remaining under the patient When the patient is to be turned, the brace is placed on the back and the canvas section is buckled to the metal part before turning is done The straps should distribute the pull evenly to avoid uneven tension Shoulder loops are fastened to prevent sagging of the shoulders in turning Not all back braces are as easy to apply and remove from the patient as the Taylor type, many require forcible spreading for application For the most part it is considered preferable to apply back braces to the patient as he lies prone

General Considerations for the Patient's Welfare—The health features of scoliosis need to be emphasized in any article dealing with the nursing care of such patients In the first place, a large part of the period of mobilization may frequently take place in the home, since hospitalization over an extended period is not always practical Instruction is given by the physical therapist, and follow up is usually done in the outpatient department at frequent stated intervals by the orthopedist If a physical therapy department is available to the patient, he may be brought in two or three times a week for exercises and treatment If this is impossible, it is essential that the parent have a thorough understanding of what such exercises consist, as well as of their purpose One instruction period given at the time the parents come to the hospital to take the patient home is seldom enough A set of written exercises will help, but unless it is illustrated is often confusing to the parent It is

material may be uncomfortably tight for the patient To remove the soiled stockinette, first loosen it around the chin and armholes with a razor blade or scissors Be sure, however that it does not slip away from you down inside the cast The new stockinette is now slipped over the patient s head, and one end of it is stitched with stout thread to the loosened soiled stockinette The stockinette around the lower chest part of the cast is then loosened and traction is exerted upon it This will take time, patience, and strength, but it can be accomplished by persistence When a new stockinette has been pulled through to the level of the arms, slits are made in it just large enough to accommodate the arms which are then pulled through The traction is now continued on the old stockinette until the new stockinette has appeared at the bottom part of the chest piece of the cast Needless to say, one nurse should never attempt this alone, three nurses are frequently necessary It is not a job which can be hurried and plenty of time should be allowed for it The blunt forceps may be necessary to pull the stockinette through a very tight cast, and the nurse must be very careful not to pinch the patient while using them When the stockinette has been entirely pulled through the old material is cut off and the new is folded back over the cast at all its edges The plaster bandages are then moistened and the new stockinette is incorporated into the cast with it This makes a neat edge if it is faithfully rubbed and polished The lower part of the cast is changed in the same manner being careful to watch for twisting of the stockinette under the leg piece which might cause loss of circulation

As has been stated before surgery the doctor will fill in the cut portions of the cast making it into a solid body jacket Fenestration of the cast will then be ordered allowing for preparation of the operative site Occasionally on the morning of operation a No 20 hypodermic needle will be inserted under local anesthesia into the spinous process of one of the prominent vertebrae in the fusion site, and a lateral spinal x ray taken This ensures the location of the apex of the curve when the incision is made

After surgery, the patient usually remains in his cast for three months, at which time another cast sometimes referred to as a semiambulatory cast will be applied The period of bed rest depends upon the discretion of the doctor Immobilization is usually continued for from six to twelve months In handling these patients after spinal fusion it is well to remember that solidification is usually conceded to be present after

QUESTIONS FOR STUDY—UNIT IV

1 What are the symptoms of epiphysitis of the tibial tubercle? The pathology?

2 List two types of epiphysitis

3 In what two types of individual is slipped femoral epiphysis usually found?

4 What is the treatment for slipped femoral epiphysis?

5 What is the treatment of coxa plana?

6 Give briefly the chief differences between postural and structural scoliosis

7 Discuss the preventive aspects of postural scoliosis

8 Distinguish between the terms kyphos, gibbus, scoliosis, and dorsum rotundum

9 What is the purpose of therapeutic exercise given in the treatment of structural scoliosis?

advisable for the parent to see the exercises carried out over a period of days before taking the child home In many states, crippled children's services now provide physical therapy follow up in the home with visits by technicians The value of this service to this type of patient is in estimable

It may take considerable ingenuity to keep the child interested in his exercises month after month and year after year The child sometimes tends to become mechanical and apathetic about his exercises, and the parent, wearying of constant nagging, allows days to go by with no exercise periods The public health nurse, observing this state of affairs, should consult with the physical therapist Sometimes new exercises can be substituted for old ones which will stimulate the child to greater interest in their performance Adequate supervision for these will need to be provided until confidence is felt that the child has mastered the new set of exercises

It must be borne in mind that children of scoliotic age are at a time of life where appliances are often considered a cosmetic encumbrance, particularly to the child whose moderate curve has as yet caused him no personal embarrassment The parent, unless firmly instructed on this point, may often succumb to pleas to 'leave off" the braces for parties and dances and ultimately it may be found at checkup that the child is not wearing his brace half the time Similarly the patient may often plead to omit his exercises because he is "too busy" or 'too tired" The parent should be forewarned that these things are likely to occur He should be urged to develop emotional control and a firm attitude in these matters for the sake of the child's future welfare Only persistence in carrying out the doctor s orders combined with a thorough understanding of the long-term nature of treatment and necessity for checkup at regular intervals can be productive of permanent results in scoliosis

It should be remembered that for his total welfare the scoliotic child needs more than supervision of exercises and brace wearing Fatigue is always to be avoided, and adequate nutrition is particularly important to him, as well as careful supervision of his study, rest, and play habits Tendencies to weight loss, excessive gain in weight, or periods of rapid growth in height should be observed, and, in many instances, these may mean that the child should return to the orthopedic clinic earlier than had been planned Attention to all these details may mean the difference between success and failure in the child s treatment

Unit V
INFECTIONS OF BONES AND JOINTS

Chapter 11
OSTEOMYELITIS, ACUTE PYOGENIC ARTHRITIS

OSTEOMYELITIS

Osteomyelitis is of three types (1) acute infectious osteomyelitis, (2) acute localized osteomyelitis, and (3) chronic osteomyelitis

Cause —

1 Acute infectious osteomyelitis is usually caused by pyogenic bacteria reaching the bone through the blood stream The most common is the staphylococcus The streptococcus is the next most common Other organisms which may cause the disease are the pneumococcus, typhoid bacillus, colon bacillus, gas bacillus, gonococcus, actinomyces, coccidioides, echinococcus, *Spirochaeta pallida* and the tubercle bacillus

The virulence of the organism frequently determines the severity of the disease In some instances, especially where the infective agent is the staphylococcus or streptococcus, the disease may be of the violent fulminating type, and death may occur within twenty four or forty eight hours after the onset of the infection Young children are most often affected in the systemic type, and the areas of the body most subject to trauma are the most frequently involved Boys are more susceptible than girls by four to one

2 In acute localized osteomyelitis, the infection very often results from compound fractures or penetrating wounds into the bone This is due to the fact that drainage is already established by virtue of the fracture Such infections are rarely virulent and are not usually accompanied by a general reaction in the entire involved bone, as is seen in the metastatic infections

3 Chronic osteomyelitis occurs in cases in which the body resistance to the particular type of organism causing the infection has been built up

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In children under two or three years of age, where the bone and perios teal tissues are flexible, it is questionable whether surgery with osteot omy has any advantage Incisions and drainage of localized abscesses may be beneficial

In the average case of acute osteomyelitis, the disease usually develops less abruptly In spite of the fact that some authors have reported series of cases which seem to have been treated successfully by the use of anti biotic drugs alone without surgery, it still seems logical that relief of pressure within the bone and periosteum by incision and drainage is an advantage Much should depend on the local and general reaction of the patient within the immediate hours and days following the onset of the disease Immobilization in casts or in splints seems decidedly help ful in most cases, particularly because of the effect of muscle relaxation

Chronic osteomyelitis is one of the most persistent diseases that exist Recurrence of activity may haunt the patient throughout his life Re currences take place even after forty three years of quiescence, but ordi narily recurrences, especially with multiple involvement, develop every few months or years

The treatment of chronic osteomyelitis depends largely on the com pleteness of the removal of all dead bone (sequestra) and the prolonged use of antibiotics The use of antibiotic drugs at the first evidence of activity will frequently avert the attack One of the common methods of treatment before the advent of antibiotics was that of Dr Orr, in which removal of the sequestrum, saucerization, petrolatum packs, and immobilization in plaster of Paris casts were combined

ACUTE PYOGENIC ARTHRITIS

(SEPTIC OR PURULENT ARTHRITIS)

Acute pyogenic arthritis is most frequently a disease of childhood and is caused by pyogenic organisms such as the staphylococcus and strepto coccus According to the virulence of the organism and the susceptibil ity of the host, the onset and reaction may be mild, medium, or severe Any joint may be involved, but those most commonly involved are those most susceptible to trauma the knee, the hip, the ankle, the elbow, the shoulder, and the wrist

Infection commonly results from the combination of trauma and focal infection and enters the joint through the blood stream or by means of a penetrating wound into the joint

to a considerable extent It is characterized by intermittent exacerbation of pain and inflammation usually brought on by an attempt to throw off sequestra

Pathology—Acute osteomyelitis usually starts at the end of long bones where there is the greatest number of blood vessels The disease is usually due to the combination of two factors (1) local selectivity resulting from trauma, (2) metastatic infection from some source of remote focal infection in the body

After the bacteria are implanted in the bone, they grow and cause pressure and destruction of bone The pressure serves to spread the infection and it finally breaks through the bone surface and strips up the periosteum Most of the circulation to the bone enters through the periosteum, and the stripping effect of pus under pressure cuts off circulation to the bone Death of the bone occurs The periosteum maintains its circulation and under this stimulation tends to grow and lay down new bone, forming the characteristic "involucrum" This involucrum may extend part of the way along the shaft or along the entire distance of the shaft Within this involucrum of newly formed bone, the dead bone becomes completely detached and must either be removed by operation or else gradually work its own way out by abscess and sinus formation

Course of the Disease—The onset starts with a feeling of illness possibly headache nausea, and a rather rapid increase in temperature It is difficult at times in the acute stages to tell whether the involvement is in the joint or in the neighboring bone The differentiation can usually be made by the fact that with osteomyelitis near a joint a certain range of painless motion is present whereas with joint involvement any degree of motion is painful The blood stream may become infected so that positive cultures of the organism can be obtained, and the leukocyte count may rise to a very high level Unfortunately x ray is of no value in the early stage of osteomyelitis Positive x ray evidence of infection may not be found short of two or three weeks Even then the x ray findings may be very misleading when the progress of the disease has been marked by the administration of the sulfonamides, penicillin, streptomycin, or other antibiotic drugs Localized swelling and tenderness of the involved area occur within twenty four to forty eight hours

Treatment—In the fulminating cases operative treatment seems to offer no advantage Transfusions, infusions and the use of the antibiotic drugs offer the best means of attack

In children under two or three years of age, where the bone and periosteal tissues are flexible, it is questionable whether surgery with osteotomy has any advantage Incisions and drainage of localized abscesses may be beneficial

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Infection commonly results from the combination of trauma and focal infection and enters the joint through the blood stream or by means of a penetrating wound into the joint

Symptoms and Signs—When the infection is mild, the joint reaction may consist only in the stimulation of synovial fluid production This is called an effusion

If the virulence is greater, local reaction is further stimulated and fibrinous material (coagulated white blood cells) may cover the surfaces of the joint

If the reaction is violent, the joint may be filled with pus under considerable pressure and the symptoms are much exaggerated The temperature may rise to 103° or 104° F, the joint may become reddened, and a fusiform swelling may occur Joint irritation is notoriously painful on any attempt at motion Therefore, as a rule, violent muscle spasm of a protective nature accompanies joint irritation and exaggerates the tension and pain There is usually a marked increase in the white blood cells in the blood

Treatment—Treatment is largely dependent on the severity of the reaction

1 In the mild, serous effusions, immobilization in splints with hot water or Epsom salts fomentations every three or four hours may alleviate the pain and muscle spasm and lead to recovery or complete immobilization in a plaster cast, combined with palliative treatment and rest, increased fluids and chemotherapy, may result in a cure The removal of obvious focal infection is an important factor in treatment

2 In the more severe cases where fibrin is deposited on the joint surfaces, more extensive treatment is indicated Joint washing may be done by using two syringes inserted on opposite sides of the joint Quantities of normal saline solution are flushed through the joint until the return is clear Then, penicillin solution may be injected into the joint Immobilization should be accomplished by splints or by Buck's traction, using from 5 to 8 pounds of weight through a pulley at the end of the bed

3 If the joint reaction is severe and there is pus formation incision and drainage are usually necessary Drainage may be accomplished by a single or double incision adequate to allow complete exposure of the joint All fibrinous material is picked out with forceps and the joint is washed clean with normal saline Penicillin solution can then be infiltrated throughout the joint and the incision *closed* The joint is then immobilized in a splint or a plaster of Paris cast and the temperature and symptoms are watched closely

If there should be continued elevation of temperature or continued pain, it may be necessary to bivalve the cast and inspect the joint In severe cases it may be necessary to open the wound and institute free drainage Such technique, when it is necessary, exposes joints to secondary infection and should be avoided if possible

General treatment should consist in the administration of the proper chemotherapy combined with transfusions infusions, and physical therapy treatments

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today The nursing care involved in the Carrel Dakin treatment is such an important factor and demands so much time and careful technique from the nurse that it has become almost prohibitive in these times of personnel shortages The treatment may, of course, be carried out without this meticulous technique, but the results from it are correspondingly uncertain

Most nurses have read a great deal about the Orr treatment, or the closed plaster method of treating osteomyelitis This treatment had its inception in World War I, but was not used on a large scale until the Spanish Civil War The results from its use in World War II were such that it was generally accepted as the treatment of choice for osteomyelitis

This method has been somewhat modified during the past few years by chemotherapy and the antibiotic drugs, but the principles which Orr laid down are still considered sound and they form the basis of modern treatment Briefly stated, Orr's treatment consisted of immediate adequate surgical drainage (saucerization), the establishment of complete rest for the involved area by the use of a plaster of Paris cast which included the joint above and the joint below the infected area, maintaining the drained area open by means of petrolatum packing, and postoperative care in which rest and freedom from the interference of dressings were paramount features

The Orr technique embodies two principles with which all nurses should be familiar, principles based on respect for the inherent protective abilities of the tissues The first principle is that of complete rest This means that not only are bones and joints immobilized, but soft tissues as well Avoidance of the trauma of frequent dressings and protection against movement of the soft tissues around the infected bone will often relieve muscle spasm and promote relaxation of the part in the anatomical position The second principle is that of asepsis, which means that irritating antiseptics are not introduced into the wound, since it is felt that strong antiseptics often inhibit Nature's own powers of eliminating the infection It has been wisely said that the aim of all good treatment is to aid the healing process of nature, and the Orr technique seeks to do this consistently in osteomyelitis

Odor from the closed plaster cast, however, may often present a real problem Fortunately the effect of the odor on the patient is not nearly as troublesome as it is on nurses and attendants It is not uncommon for nurses to have wrathful relatives approach them with threats of removing the patient from the doctor's care unless the wound is opened

Chapter 12

NURSING CARE OF PATIENTS WITH OSTEOMYELITIS AND SEPTIC CONDITIONS OF THE JOINTS

The etiology of osteomyelitis presents some factors important to nurses in their health teaching. It is, of course, a well recognized fact that compound injuries of bone may lead to osteomyelitis, but what is not always so well understood is that *any* lowering of the resistance or integrity of the tissue may predispose toward the disease. Body resistance lowered through exposure, fatigue, malnutrition, infected tonsils and teeth seems to be a definite factor in the etiology. A history of boils is a very common feature in osteomyelitis. Bruises, blisters, deep slivers or splinters, impetigo, sties of the eyelids, all are given consideration as possible etiologic agents by writers on this subject. Any of these types of skin lesions deserve careful attention, and the nurse in her teaching should seek to make it understood that a child with extensive skin abrasions should not be allowed to resume normal athletic activities until they are healed. Blisters on the heel—a very common disturbance in the life of young people—should be carefully disinfected and protected from the irritating shoe by felt pads. This cannot be overemphasized. Boils deserve medical attention. Remember that the staphylococcus, chief organism in the common boil, is the same staphylococcus which is the cause of the more serious type of osteomyelitis.

The earliest local symptom is likely to be severe sudden pain, boring in nature, somewhere near the region of a joint. Systemically, a chill followed by high fever may introduce the condition. Abruptness and severity of pain are emphasized as the two most notable features of this condition.

NURSING RESPONSIBILITIES IN VARIOUS METHODS OF TREATMENT

It is significant that the two main systems of treatment used today were evolved from recent wars. The first is the Carrel-Dakin treatment, used during the war of 1914-1918 and still preferred by some physicians

patient is able to retain them, intravenously if he is unable to do so Blood transfusions are often part of the early treatment in this disease The presence of sufficient protein and vitamin C in the diet of these patients is of the utmost importance, since both of these substances are vitally necessary for wound healing Every effort should be made to see that foods containing these are included in each meal, even though the patient be receiving only a liquid diet

A highly important fact to remember in caring for the patient with osteomyelitis is that deformity is a common sequel to the disease The patient tends to hold the limb in a position that causes the least possible strain on the inflamed bone Nearby joints are likely to be held in a position of flexion in order to relax muscles, in an osteomyelitis of the lower end of the femur you might observe flexion in the hip, flexion in the knee, and a tendency to outward rotation of the whole leg Drop foot is another feature which develops early It is customary that as soon as drainage has been established, the physician in charge will see to it that a splint of some kind is applied to the patient's extremity to hold it in an optimum position However, if a period of days goes by during which time perhaps hot stupes are being used, and no splint is in readiness, the nurse must improvise equipment to keep the foot in a normal position A foot board or box, augmented with pillows, usually causes the patient very little discomfort Many writers tell of case histories in which a single focus of osteomyelitis is satisfactorily healed, but the patient is nonetheless permanently crippled by flexion deformities of knee and hip and the resulting equinus position of the foot in walking Contractures of muscles alone may cause the deformity Although edema is very common in the early stages of osteomyelitis, and splinting may be very difficult, some attempt at maintaining optimum joint positions should be made

Hot fomentations are sometimes ordered for acute osteomyelitis Unnecessary manipulations must be avoided because of the excruciating pain which the patient suffers on movement For this reason outer coverings for the packs (dry blanket and waterproofing) should be left in place between the treatments Material for the wet packs should be of lightweight wool flannel or blanketing, not cotton blanketing or bath towels, which tend to be too heavy and do not retain the heat well Temperature of the water should be around 150° F, but the stupe should be tested against the inner aspect of the nurse's wrist before she applies it to the patient The danger of using too hot water is very great—the patient s pain is so severe that he will scarcely be able to tell

and dressed The nurse can give effective reassurance to the family only if she herself understands the principles underlying the closed plaster method of treating infected bone wounds and the amazing results which have been obtained by use of this method

On the whole, attempts made to deodorize these casts have been more ingenious than successful Bags of charcoal have sometimes seemed to offer a little relief from the odor Commercial type deodorizers are partially successful For the most part, however, there seems to be no substitute for frequent airing of the patient's room

While the use of penicillin and other antibiotics has changed the treatment of osteomyelitis in some respects, provision for adequate rest of the involved area is still considered very important In the acute stage of the disease, the tendency is to institute penicillin therapy before resorting to surgery However, the administration of the antibiotic drugs does not always insure recovery and must often be accompanied by adequate drainage There has always been controversy about surgery in the acute stage, particularly when bacteremia and general prostration were present, since it has been recognized that the systemic features of the disease may often be of more immediate importance than relief of local symptoms If surgery is done in the acute stage, it is usually swift and conservative, consisting of a series of drill holes made through the metaphyseal portion of the bone to evacuate pus and relieve tension More adequate drainage may need to be done later Penicillin may be a lifesaving treatment in the severer forms of osteomyelitis accompanied by septicemia The patient is usually given the drug parenterally every three hours, and, if localized abscesses occur, the drug may be used in the wound as well Penicillin solution is maintained in the wound by positioning of the extremity, by compression dressings, or by inserting a sterile catheter or polyethylene tube into the wound, and permitting the solution to drop in slowly and continuously

In some instances the organism causing osteomyelitis is found to be resistant to one or more chemotherapeutic agents, but where possible, penicillin will be used, since it is a powerful bacteriostatic agent and is particularly fitted to the treatment of osteomyelitis because it is not inhibited by the presence of pus or large numbers of bacteria

GENERAL NURSING CARE OF THE PATIENT WITH OSTEOMYELITIS

The patient's general condition should be of as much concern as the local condition Fluids should be given in abundance by mouth if the

knee, and another hand should support the ankle and foot steadily. Every movement of your hands in lifting must be smooth, unhurried, infinitely careful. Unless you observe these things, your patient's confidence will be lost and he will resist bitterly any further manipulation. If you attempt to turn him to the side, the limb must stay on a level with his body and not be allowed to sag as you turn him. It can be supported by firm pillows, never soft ones. Gentleness in handling is imperative for another reason: pathological fractures have been known to occur as early as ten days after the onset of osteomyelitis. Such fractures are frequently overlooked because the accompanying pain is often wrongly attributed to the concurrent disease.

COMPLICATIONS IN OSTEOMYELITIS

Besides the drug reactions which may possibly occur from the use of the antibiotics or the sulfonamides, nurses should be alert to any signs which might indicate that the disease has progressed to other parts of the skeleton. Any swelling, redness, or pain in the neighborhood of bone must be reported at once. Metastasis to the jaw in severe cases is sometimes overlooked because the nurse and patient may attribute the pain in this area to a wisdom tooth.

Amyloidosis, a waxy degeneration of the liver, spleen, and other organs, is a late and often terminal symptom, and may be manifest by the presence of blood, pus, or albumin in the urine.

There is considerable danger of a pathological fracture during and after osteomyelitis, due to loss of bone substance. The extremity that has been involved must be handled with great care, even after the period of tenderness and pain has past. When the patient is allowed to be out of bed, he must be guarded against falls, jerky movements, or any mishap which might threaten the integrity of the weakened bone. Sudden pain, crepitus, or deformity must be reported immediately. A sudden malposition of the limb may be the first indication that fracture has occurred in that area, for pain is sometimes disguised by the general discomfort of trying to walk after many weeks in bed.

AFTERCARE

Chronic osteomyelitis, because of its tendency to recurrence, is a source of much economic waste. Long hospitalization is usually necessary, and careful follow up after discharge is indispensable. The duties of the public health nurse in education of the family as to the need

that the water is too hot A setup such as is used for the Kenny foments would be ideal for joint packs, that is, a wringer and tub or bucket However, stupe wringers will suffice very well Where there is necessity for sterile precautions because of an opening in the skin, a sterile dressing may be placed on the wound and covered with oiled silk or Pliofilm in such fashion that the moisture from the wet packs will not come in contact with the sterile field Double thickness triangles of flannel have universal application for packs around joints A thirty two inch square of material folded in a triangle is applied to the knee with very little manipulation in the following fashion the apex of the triangle (the 90 degree angle) is placed on the inner aspect of the thigh halfway between knee and groin The upper acute angle of the material is then very gently pushed under the outer thigh at this same level until it contacts the inner piece, that is, the right angle The third angle, which is at the level of the midcalf is pushed gently under the leg at that point until it contacts the blanket on the outer aspect of the calf The whole is immediately covered with waterproofing and outer dry blanket which has been laid under the limb before applying the wet pack

HANDLING OF THE AFFECTED AREA

The patient with osteomyelitis or septic arthritis is usually extremely apprehensive, and part of this apprehension is due to his fear of being moved He may even cry out if the bed is touched, so severe is his pain Because it will be necessary for the nurse to move these patients to a certain extent, the manner of handling an acutely inflamed joint or extremity must be brought to mind here

Persons who have had osteomyelitis or a septic joint tell us that the pain of being moved is almost intolerable The moving of an acutely inflamed joint should not be undertaken without help But all the help in the world *will do no good if the principles of joint immobilization are* not understood and faithfully carried out It is not enough that you carefully immobilize the joint or the part infected the joint above and the joint below must always be immobilized as you move the patient to prevent movement in the infected area This will be readily understood if you recall muscle action on joints and remember that the muscles which act to move one joint may also serve as a flexor or extensor of the one above or below it Because this is true the moving of a knee in which, or near which a septic condition exists can be accomplished painlessly only by immobilizing the hip and ankle as well as the knee This will require three hands Support should be given under hip and

casts, upper respiratory passages and fingers of nurses and doctors during dressing periods, and, of course, unsterile instruments and dressing equipment

Carelessness in sterilizing instruments and in using the unwashed hands to apply dressings has been the rule rather than the exception in doing septic dressings In some instances it has been the custom to remove all dressings before ward rounds in order that the attending physician may see the wound without unnecessary delay This is a dangerous procedure because contamination and cross infection can so readily take place in a ward where dressings on many infected patients are opened to the air at the same time The time a wound is exposed to the air should always be kept at a minimum

In removing dressings from contaminated wounds, it is advisable to cut the bandage through and remove it in one piece If the bandage is unwrapped, it tends to lose considerable lint and dust into the air, and this lint may very easily hold bacteria that will infect other wounds in the neighborhood

While it is extremely important that all patients with infected wounds be housed in a ward separate from that used for clean patients, it is also desirable that patients with septic wounds be dressed in a room set aside for this purpose Greater protection against cross infection is possible if this can be done

PYOGENIC ARTHRITIS IN INFANTS

Pyogenic arthritis, particularly of the hip, is often seen in babies on pediatric wards Before the advent of penicillin, this type of joint infection was an extremely serious condition Chemotherapy is now usually begun immediately on such patients, and surgical treatment is used only when necessary The joint affected is immobilized by means of simple traction or a bivalved cast Hot fomentations will often be ordered for the joint Fluids and blood transfusions will be given, and aspiration of the joint under aseptic conditions may be done If the child can be brought through the acute phase of this disease, the chances for recovery are good

for close observation and supervision of the activities of the patient are manifest The dangers of neglect, the possibility of deformity, fracture, and stiffness of joints, must be carefully pointed out, as must the ever present danger of recurrence The chronicity of the condition must be explained also to avoid discouragement Too many of these patients are withdrawn after a period of time from the hands of a qualified practitioner and placed in the hands of fake healers Frequent return *to the clinic for checkup must be stressed*

Psychotherapy in these patients is important Impatience, bitterness, and discouragement are to be fought with skill and sympathy on the part of the nurse So often the osteomyelitis patient who considers him self well on the road to recovery develops another abscess which will delay his return to a normal life for a longer period, and, after this has happened to him several times, a young, active man may very easily develop mental habits of despair and bitterness A program of occupational therapy designed to stimulate such activity as the patient is capable of is the best antidote for this sort of complication The patient should be kept as busy as possible with a constructive program of work, diversional as well as practical

Rehabilitation of these patients presents a real problem Strenuous work is usually contraindicated, because of the tendency of flareup in the face of future trauma The danger of trauma or strain must be taken into consideration in rehabilitation All hazardous occupations risk the patient's future This should be explained to him and his family by the physician, in aiding him to select a future occupation An attempt to discover and develop latent talents in these patients can be made by the nurse and the occupational therapist during their time on the hospital wards

DRESSINGS IN OSTEOMYELITIS

Very negligent technique often accompanies the dressing of draining bone wounds in hospital wards The monotony of doing these dressings over a period of weeks or months may account for this lowering of standards Nurses should remember that open wounds such as those encountered in chronic osteomyelitis provide an almost perfect culture media for bacteria Cross infection is an ever present danger in such wounds, and cross infection may sometimes mean the difference between recovery and chronic invalidism to the patient Cross infection may be brought about by many agents dust and lint particles in the air, soaked dressings which come in contact with contaminated bed linen or

demonstrated either through the presence of tubercle bacilli, tubercles, or granulation tissue characteristic of tuberculosis

The development of the tuberculous process in joints starts in most instances between the ages of two and five, but may start later The disease is not inherited and is usually acquired through the association and contamination with older individuals having active or quiescent tuberculous lesions in the lungs

Tuberculosis of the joints is rarely transmitted to other individuals except through very careless handling of dressings from draining sinuses when they exist It must be remembered, however, that the disease is progressive when untreated and does not become checked the minute the surgeon sees it and the diagnosis is made It frequently progresses for six to ten months after treatment is started

TUBERCULOSIS OF THE SPINE

Symptoms—About half of all cases of bone and joint tuberculosis occur in the spine The first symptoms are usually stiffness, muscle spasm, and a tendency to reach things on the floor by bending the knees rather than the back

At first the symptoms may be intermittent and are relieved by comparatively short periods of rest The intermittent characteristic may cloud the early diagnosis

Pain may be referred to the limbs, and this fact emphasizes the point that examinations should not be made without the complete removal of all clothing The complaint may be remote from the actual disease

The lower dorsal and upper lumbar spine is most frequently affected, although tuberculosis of the cervical spine and dorsal spine is not uncommon The greatest deformity develops when the involvement is in the dorsal spine, and its compensatory adaptation to the neighboring uninvolved joints is less effective than in the lumbar and cervical spine

The characteristic deformity in tuberculosis of the spine is the development of a "gibbus" This is an angulation or pronounced anterior posterior curve of the spine such as is seen in the hunchback This deformity develops only as the result of destructive lesions in the spine and in fractures In some instances with destruction of one, two, three, or four vertebral bodies, the deformity is so severe that the segments of the spine above and below the destruction become parallel and the anterior margins of the bodies of the vertebra rest upon each other

Paralysis in tuberculosis of the spine occurs occasionally Strangely, it is rarely due to the mechanical disturbance in the alignment of the

Chapter 13

TUBERCULOSIS OF THE BONE AND JOINTS

There are three types of tuberculosis of the bone the human, the bovine, and the avian The avian (bird type) is quite rare

TUBERCULOSIS OF BONE

Tuberculosis at the end of long bones may manifest itself in the following forms (1) encysted tuberculosis, in which there is localized destruction of bone surrounded by a wall of thickened bone tissue, (2) infiltrating tuberculosis which is rapid in development and is frequently followed by rapid bone destruction and sequestration, (3) synovial tuberculosis, with thickening of the synovial tissue and the formation of the 'rice bodies' within the joint

Tuberculosis of the bone usually involves that portion which is in the vicinity of a joint Occasionally tuberculous infection in the bone may manifest itself in the form of an irritation of the periosteum and cortical bone, but usually it starts within a joint and extends to the medullary portion of the bone only by secondary invasion from the joint The original involvement of the joint itself is usually through the blood stream by means of an infarct or localization of the bacteria at the end of the arterial system Hence, primary involvement may occur (1) at the end of the long bones or (2) along the periosteum of the long bones

Clinical Picture —Tuberculosis of the joint usually develops as an insidious disease, but at the onset there is only occasional pain and muscle spasm about the joint There might be a slight elevation of temperature without leukocytosis, and a positive intradermal tuberculin test may be present For an accurate diagnosis of a tuberculous joint, material should be aspirated and injected into a guinea pig In six weeks the guinea pig is examined by autopsy and the presence or absence of tuberculous organisms and exudate is determined by macroscopic and microscopic study This test is the most accurate way of making a diagnosis of tuberculosis, although the time element is sometimes inconvenient

Another accurate means of diagnosing tuberculosis in joints is biopsy Material from the joint surface and synovial tissues can be removed and examined microscopically If tuberculosis is present, it can usually be

demonstrated either through the presence of tubercle bacilli, tubercles, or granulation tissue characteristic of tuberculosis.

The development of the tuberculous process in joints starts in most instances between the ages of two and five, but may start later. The disease is not inherited and is usually acquired through the association and contamination with older individuals having active or quiescent tuberculous lesions in the lungs.

Tuberculosis of the joints is rarely transmitted to other individuals except through very careless handling of dressings from draining sinuses when they exist. It must be remembered, however, that the disease is progressive when untreated and does not become checked the minute the surgeon sees it and the diagnosis is made. It frequently progresses for six to ten months after treatment is started.

TUBERCULOSIS OF THE SPINE

Symptoms.—About half of all cases of bone and joint tuberculosis occur in the spine. The first symptoms are usually stiffness, muscle spasm, and a tendency to reach things on the floor by bending the knees rather than the back.

At first the symptoms may be intermittent and are relieved by comparatively short periods of rest. The intermittent characteristic may cloud the early diagnosis.

Pain may be referred to the limbs, and this fact emphasizes the point that examinations should not be made without the complete removal of all clothing. The complaint may be remote from the actual disease.

The lower dorsal and upper lumbar spine is most frequently affected, although tuberculosis of the cervical spine and dorsal spine is not uncommon. The greatest deformity develops when the involvement is in the dorsal spine, and its compensatory adaptation to the neighboring uninvolved joints is less effective than in the lumbar and cervical spine.

The characteristic deformity in tuberculosis of the spine is the development of a "gibbus." This is an angulation or pronounced anteriorposterior curve of the spine such as is seen in the hunchback. This deformity develops only as the result of destructive lesions in the spine and in fractures. In some instances with destruction of one, two, three, or four vertebral bodies, the deformity is so severe that the segments of the spine above and below the destruction become parallel and the anterior margins of the bodies of the vertebra rest upon each other.

Paralysis in tuberculosis of the spine occurs occasionally. Strangely, it is rarely due to the mechanical disturbance in the alignment of the

spine, but rather to the effect of abscesses, granulation tissue, and other accompanying factors in the tuberculous disease For this reason treatment of paralysis usually consists in rest and immobilization These agents have a tendency to diminish inflammatory factors and relieve nerve pressure In rare instances it may become necessary to relieve bony pressure by laminectomy

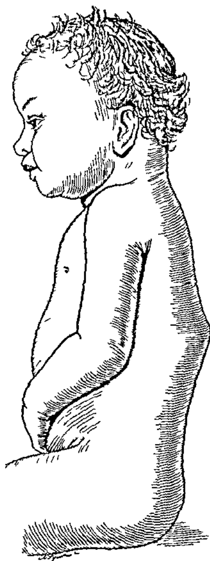


Fig 157 —Tuberculosis of the lower dorsal spine with angulation or gibbus

Treatment—The treatment of tuberculosis of the spine depends considerably on the advance that the disease has made at the time the case comes under observation and on the age of the individual in which

treatment is considered It must be remembered, however, that the disease does not halt the minute the surgeon sees it!

There has been a great deal of discussion as to whether or not spinal fusion operation offers the best means of arresting tuberculosis of the spine in young children Some authorities are of the opinion that, due to incomplete epiphyseal development, fusion of the spine in younger children does not protect them from further deformity

It is a well-established fact that tuberculosis of the spine cannot be considered cured until there has been bony union of the vertebrae above and below the diseased process The time required for this to occur, with or without fusion, is from three to ten years During this period, every attempt should be made, through casts and braces, to maintain as nearly as possible an erect position of the spine



Fig 158—A complete body cast has been applied to maintain immobilization and good position for this patient with a tuberculous spine Note placement of pillows to support extremities

In conservative management of tuberculosis of the spine, treatment consists of immobilization and the use of drugs Institutional care including fresh air, sunshine, proper diet, and hygienic surroundings is an important factor This treatment may require from eighteen months to five years for a cure

There are a good many arguments in favor of spinal fusion, especially in older children and adults Nature automatically fuses the lamina and articular facets when spinal disease has existed over a period of years Unfortunately, Nature's fusion accompanies the destruction rather than precedes it Hence, there is a protective mechanism on her part for

that area which has been involved but she gives no protection to the advance of the disease to other vertebrae Frequently as many as four or five vertebrae undergo complete or partial destruction

The two most common forms of operative fixation are the methods of Hibbs and of Albee The Hibbs method consists in an operation exposing the spinous process, lamina, and articular facets of the vertebrae by submuscular and subperiosteal dissection All available bone is turned upward and downward by means of a chisel so that a mass of bone slivers and chips covers the denuded areas of the spine The articular facets are curetted to remove their cartilage Bone thus obtained may be augmented and better fusion insured either by the use of bone from the crest of the ilium or from the bone bank The muscles and periosteum are then brought back over the area and are placed so as to maintain apposition pressure on the chips and fragments Eventually, the posterior portion of the spine develops a continuous bridge of bone, acting as a brace or internal fixation The spine in that region becomes rigid

The Albee operation is simple to perform, since it consists in the splitting of the spinous processes and the insertion of a bone graft (usually taken from the tibia) The graft is fastened into position and eventually forms solid union and a bracing effect

Whatever operation is used, the fusion should be carried out to at least two vertebrae above and below those involved in the diseased process

Ordinarily, spinal fusion operations are protected for a time by casts These are followed by protective braces for an additional time When tuberculosis exists in the cervical spine the cast or brace must extend up to and including the chin and head

There are many ingenious types of apparatus for obtaining and maintaining correction and immobilization in tuberculous lesions of the spine

Abscess formation occurs in a fairly large percentage of cases of tuberculosis of the spine In the cervical region the abscess may develop in the pharynx, causing difficulty of breathing In the dorsal region, it may occur in the mediastinum and may rupture into the lung In the lumbar spine, an abscess may develop between the lumbar muscles or in the gluteal region, or it may follow the course of the iliopsoas muscle and point in the groin This is the most common form (psoas abscess)

The indication for opening a 'cold abscess is when pressure is great and spontaneous rupture likely Relief of pressure may be accomplished

by aspiration with a large needle or trocar through a *nondependent* portion of the abscess Incision may be made and the abscess evacuated and the incision firmly closed

TUBERCULOSIS OF THE HIP

Tuberculosis of the hip constitutes the second largest group of tuberculous joint involvements



Fig 159 —X ray of a tuberculous hip In the picture on the left the head of the femur and the joint space are still well defined As the infectious process continues the joint cartilage is destroyed calcium is deposited and eventually motion in the joint is destroyed

Symptoms and Signs —The disease usually starts at an early age (one to three years) with a limp of gradually increasing severity The hip becomes slightly flexed, *abducted and externally rotated,* and the child has a tendency to walk on the toes of the affected side 'Night cries are frequently present These are caused by a definite mechanism The muscles relax in sleep and the joint is unprotected In the subconscious state, body movements may occur and the joint may become irritated There is an immediate violent spasm of the muscles which causes severe pain by bringing the irritated joint surfaces together and the child cries out as he awakens

As the disease progresses, the destruction of the head of the femur and possibly of the acetabulum increases and the deformity changes *Adduction and internal rotation* develop, while the flexion deformity remains

Diagnosis —The usual methods of clinical and laboratory diagnosis of a tuberculous joint are used In the more advanced cases the characteristic destruction, as shown by x rays, is in itself almost positive proof of the disease

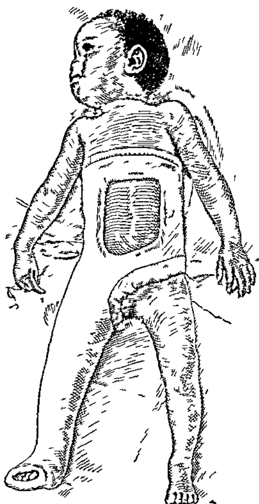


Fig 160 —Plaster spica cast for immobilization in tuberculosis of the hip in a young child (From Shands Handbook of Orthopaedic Surgery)

The symptoms are more severe than they are in Legg Perthes disease and slipped upper femoral epiphysis, and less severe than they are in acute pyogenic arthritis of the hip

Treatment —During the early stages and in younger children, recumbent treatment is combined with the use of drugs

In the more severe cases, particularly in children past six or eight years of age, fusion of the hip should be done by operation There are several methods of accomplishing fusion, but all successful methods con

sist in some form of bone graft between the femur and the pelvis and growth of this leads to solid bone formation between these two structures and the elimination of joint function Tuberculosis seems to lose its affinity for a joint when motion and friction are eliminated Following fusion operations, a plaster of Paris cast is applied from the chest to the toes of the affected side The position of the hip joint is of considerable importance There should be from 10 to 20 degrees of flexion and, if there has been some destruction, about 5 degrees of adduction to give the best weight bearing line Approximately six to eight months are required for bone healing following hip fusion This must be determined by x ray

TUBERCULOSIS OF OTHER JOINTS

Tuberculosis of the Carpal and Tarsal Joints

When tuberculosis affects joints which communicate with each other and which are partially separated by cancellous rather than cortical bone, the progress of the disease may be very rapid and destruction may be very difficult to control The characteristic symptoms and signs—pain, swelling muscle spasm, and limitation of motion—are present

In tuberculosis of the distal joints of the limbs, the swelling is usually fusiform or pear shaped in character, and sometimes abscesses develop relatively early There are usually some redness and tenderness, but only moderate elevation of temperature The diagnosis is substantiated by x ray and biopsy The x ray is characterized by destruction without repair

Treatment —An attempt at conservative treatment with drugs and immobilization in plaster of Paris should be made The plaster should extend so as to include the joints above and below the involved area In the wrist, resection of the carpal bones with operative fusion of the metacarpals to the radius may accomplish a cure

In case the bones of the foot are involved, local curettage of the affected areas, followed by immobilization, may lead to improvement if combined with complete rest and general hygienic treatment, but frequently, from an economic standpoint and the future health of the individual, amputation well above the area of involvement is the treatment of choice

Tuberculosis of the Knee and Elbow, Synovial Type

The synovial type of tuberculosis involves the knee and elbow more frequently than any other joint It is often amenable to treatment

by immobilization in the milder cases and synovectomy in the more severe However, joint tuberculosis is the most common type and, when the diagnosis has been proved, operative fixation of the joint should be done This is best accomplished by the removal of all hypertrophied synovial tissue and the cartilages of the joint surfaces, and by supplementary fixation of the joint by penetrating bone grafts



Fig 161 —Immobilization of a tuberculous shoulder joint by application of a shoulder spica cast Note abducted and flexed position of the arm

Tuberculosis of the Shoulder

Type 1 Tuberculosis sicca This is an inactive form of adult tuberculosis which causes rather marked limitation of motion but comparatively little pain or other symptoms The diagnosis is made by the history and by x ray

Type 2 Destructive tuberculosis Although insidious in origin, this type of tuberculous involvement shows the typical fusiform swelling

about the joint and there is extreme pain and muscle spasm on any attempt at motion X ray pictures show extensive destruction in the head of the humerus and eventually there is collapse

Treatment —If the disease has not advanced too far, an attempt should be made to fuse the shoulder joint in a position of approximately 70 degrees of abduction Frequently these cases are not suitable for fusion and a removal of the head of the humerus may be necessary to effect a cure

Chapter 14

NURSING CARE OF PATIENTS WITH SKELETAL TUBERCULOSIS

Skill in the care of patients afflicted with skeletal tuberculosis, to the present day nurse, is not determined merely by the dexterity she displays in the turning of a tuberculous spine patient from his frame, or her success in keeping him immobilized by ingenious restraints Ten years ago this was perhaps true, and while the importance of these details is still fully appreciated, there is a broader significance to the nursing care of these individuals than that which the nurse gives to the patient in the hospital The modern nurse knows that this disease has had its inception far back in the life of the child, perhaps in a household that included an adult relative having tuberculosis in some contagious form She sees that the child is a member of a family whose housing conditions perhaps were such as to compel the child to sleep in the same bedroom, or even the same bed, with that relative She recognizes too, the important part that poor nutrition, as well as poor environment, may have played in the life of that child She reads in the history the story of the delay in treatment when the first mild symptoms of weight loss, fatigue and anorexia, or disinclination for his usual tasks and games, became evident in the child a delay perhaps engendered through ignorance on the part of parents, or wrong advice given those parents by well meaning friends, which sent the child to some practitioner of pseudo medicine The nurse sees further than this she sees the day perhaps not too far hence when the child and his frame or brace or cast will return again to this same unwholesome environment, for children with skeletal tuberculosis seldom spend their entire period of recumbency in the hospital 96 per cent of the period of recovery is spent in the home, according to Steindler Because these things are true, the nurse sees the imperious necessity of training the family in the long time care of these children, if they are not to return to the hospital, six months or a year later, far worse than they were when first seen—with new foci of the disease in other parts of the body, perhaps with draining sinuses, with limbs flexed rigidly into unnatural positions, or, most grave of all, with beginning paralysis of the lower limbs

TEACHING PREVENTION

It is not enough that the nurse see in the tuberculous patient a challenge to her manual skill, she must see this further challenge to play her part in the education of the public as to the causes, prevention, and necessity for prompt treatment of this disease To regard herself merely as an institutional nurse, on whom no responsibility falls because she has had no public health experience, is a kind of professional isolationism which is inexcusable

It seems strange that in this day and age there is so much misrepresentation prevalent about tuberculosis of the bones and joints It seems strange, also, that there are still in many families tuberculous parents coming in daily contact with their very young children One physician has stated that pulmonary tuberculosis is as contagious to a child under four as measles And yet it is not at all infrequent, rather it is the rule, to read in the history of these children on admission to the hospital that the child's mother or father has pulmonary tuberculosis and is nevertheless residing in the same house with the children Recently a student nurse came out of a room where a child of five was dying with tuberculous meningitis, complicating tuberculosis of the hip "The father is in there," the student said, aghast, "and the mother asked him to go home and heat the bottle for the baby!" The father was a tuberculosis patient at the veterans' hospital in the city, ambulatory for part of the day

Later, when the physician in charge was informed of this and spoke to the mother about the very grave danger for her young baby, the mother admitted that she had no idea that babies could get tuberculosis from adults

The danger of young children exposed to tuberculous adults cannot be overemphasized At least the exposure need not be prolonged or repeated Much investigation of late years has revealed the danger to young children from servants who have the disease in some unrecognized form Schoolgirl help, coming in to relieve the parents in the evening, has been shown to present a menace Since dairy cattle have been placed so well under control, it is now known that practically all tuberculosis in children is contracted from adults And this situation is now as important to eliminate as was the dairy cattle situation a few years ago Some states even go so far as to require statements from teachers that they have been examined and are free from the disease Certainly this should be encouraged to extend to all domestic help and baby sitters who come in contact with young children

The prophylaxis of tuberculosis, briefly stated, is this early diagnosis, segregation of infectious cases, more adequate treatment of discovered cases before they become clinically active Preventoriums for the care of children in the households of tuberculous parents are in use in many states These children, while not overtly infected, are given the care and observation necessary to overcome the predisposition that such children so exposed may have to the disease

NURSING CARE

The necessity for local rest is manifest to the nurse immediately Frequently her concern for the spine or extremity involved is so great that she forgets that tuberculosis is a *constitutional* disease Nurses do not always carry over their training in the care of adult pulmonary tuberculosis patients to the orthopedic ward and their skeletal tuberculosis patients The need for rest that is *general*, as well as local, is just as great with these individuals, and should be borne in mind constantly It is not enough that the patient with a tuberculous spine lie on his frame, his Schwartz shell, or cast, the entire day without rest or sleep periods It is not enough that he be fed the regular three meals a day ordered for the other patients on the ward plentiful though these seem They are not enough for his exceptional needs "We must not forget," states one authority that tuberculosis is the fight between the invaded organism and the invader and it is not the bacterial invasion alone which decides the issue, but the latter is the result of the adequacy or inadequacy of body resistance in its fight against the invading organism' (Steindler)

We must give the best weapons we can for this battle rest general as well as local nutritious food recognizing always that the patient is recumbent and has no exercise and that he cannot utilize carbohydrates too well but that he has an urgent need of fats and proteins The tuberculous patient is likely to be deficient in vitamins, and a considerable degree of anemia may exist

SUN TREATMENT

Sunlight is another weapon that must be provided the tuberculous patient Given in graduated doses, it adds much to the benefit of the patient's environment Its value in aiding the system generally is undisputed, it is bactericidal, analgesic, hematonic in that it increases the

number of red and white blood cells, and aids in building body resistance Its effect on the general morale of the bedridden patient is one of its most amazing features

Too florid claims as to its local effect have brought heliotherapy into disrepute among some physicians Yet most orthopedists assure us that sunlight, combined with local and general rest, good food, and pleasant surroundings have never been disputed in their combined healing effects on the patient with skeletal tuberculosis



Fig 162 —Heliotherapy treatment third day of Rollier treatment Exposure feet and ankles 15 minutes calves 10 minutes thighs 5 minutes

The Rollier regime for administering heliotherapy, developed and standardized a generation ago, is still the most commonly used method of sun treatment Charts of heavy cardboard, showing the system of administering the sun treatment, should be on every sun deck and another smaller sheet should be attached to each patient's chart The charting on this sheet should be most faithfully done On days when, for one reason or another, it is impossible to expose the patient to the sunlight, the reason should be given in the space left for charting the

sunlight treatment In this way, overexposure, as well as neglect of part of the body, may be eliminated

The first day's exposure consists of five minutes to the first zone of the body (i e, foot and ankle) Even five minutes may be too long in young fair children, or older children of the red haired type on hot summer days The second day's exposure is five minutes to the second zone (ankles to above knees) and ten minutes for zone one The third day, five minutes' treatment is given to zone 3 (knees to groin), ten to zone 2, and fifteen minutes to zone 1 The progression thereafter is exactly the same, beginning each zone with five minutes, and working up daily an additional five minutes on the part The head is not considered a zone, and the eyes are always protected by sun glasses Where pulmonary tuberculosis exists, the chest is often omitted from sun treatments When any of the sulfa drugs are being administered, sunlight treatment is discontinued Where irradiation is being done, sunlight is usually omitted also Other features contraindicating sun treatment are nausea, dizziness, and headache Sun treatment is best given in the morning preferably early during the hot months of summer

Too vigorous a dosage is to be discouraged, a patient should never be allowed to become burned If the skin seems red from the previous day s treatment, the treatment for the day should be reduced markedly or omitted

Where a period of cloudy weather prevents treatment over an extended period the whole series of treatments should be begun from the first If this is not done, burning is likely to result

The length of time for ultimate exposure will vary with the climate and the educational activities of the child From three to six hours daily is considered advisable in good weather Full exposure may be made after the patient has worked up to the sixteenth day, for at that time the whole body has been exposed at least one hour to the sun s rays, and considerable pigmentation will have taken place Nurses should understand that where heliotherapy may be optional in certain other patients on the orthopedic ward, it is essential in the treatment of the individual with skeletal tuberculosis, just as rest and good diet are essential, and it is not to be omitted without sufficient cause

DRUG THERAPY IN SKELETAL TUBERCULOSIS

During recent years, antibiotics have been used extensively in the treatment of bone and joint tuberculosis A high percentage of patients treated with streptomycin or dihydrostreptomycin have shown marked

improvement When administering these drugs, it is important that the nurse be alert for toxic reactions These have been rather common, but, for the most part, have been mild and transient They include the vestibular disturbances, deafness and the *sensitization phenomena, fever,* rash chills, and nausea However, serious damage to hearing and the vestibular apparatus may be caused by prolonged use of large doses of the drug Para aminosalicylic acid (PAS) is given with streptomycin and in this combination bacterial resistance to streptomycin is delayed The toxic effects of PAS are nausea vomiting abdominal discomfort and anorexia These drugs have their greatest value in the early treatment of the disease before ischemia and necrosis of bone have taken place

Isoniazid and iproniazid are newer drugs, which have had a somewhat limited but seemingly valuable use *in the treatment of tuberculous bone* and joint

It must be remembered, in the treatment of tuberculous bone or joint, that good nutrition, immobilization, and rest are fundamental When good general care, and surgery when indicated, is coupled with the use of antibiotics, it is usually possible to shorten the healing period By shortening the healing period, secondary complications such as renal calculi and joint deformity may be prevented

NURSING CARE IN TUBERCULOSIS OF THE SPINE

Because tuberculosis of the spine (sometimes called Pott's disease, after Sir Percival Pott who first described the syndrome over 150 years ago) is most frequent in occurrence of the skeletal tuberculous lesions, the care of patients so afflicted will be dealt with in full Tuberculosis of the other joints of the body needs the same general care Usually the local care of the other types of skeletal tuberculosis is somewhat simpler for the nurse in that their immobilization is most commonly accomplished by circular or bivalved plaster casts whose care is described elsewhere in this book In these cases the nurse must employ her best technique of cast care She must constantly be on the alert for abscesses which have begun to drain beneath the cast, and her sense of smell is the best agent she has for discovering these She must depend upon the patient's weekly weight chart, a record of his appetite and rest habits, his pigmentation from his heliotherapy treatments, and his general appearance of well being and absence of symptoms of recurrence—undue fatigue, night cries, irritability or apathy—to assure her of his progress

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DRUG THERAPY IN SKELETAL TUBERCULOSIS

During recent years, antibiotics have been used extensively in the treatment of bone and joint tuberculosis A high percentage of patients treated with streptomycin or dihydrostreptomycin have shown marked

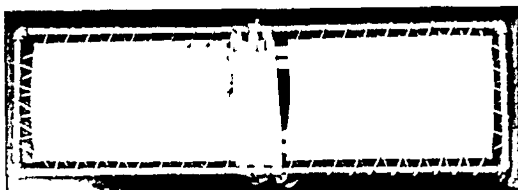


Fig 165 —Bradford frame and canvas cover laced with ropes (From Speed and Knight Campbell's Operative Orthopaedics, ed 3, The C V Mosby Company)

Fig 166 —Canvas frame cover with webbing straps and buckles (From Care of Infantile Paralysis in the Home A Handbook for Parents prepared by A Steindler and T J Greteman Courtesy the authors)

Fig 163

Fig 164

Fig 163 —Bradford frame

Fig 164 —Bradford frame with canvas covers protected by small sheets (From Care of Infantile Paralysis in the Home A Handbook for Parents prepared by A Steindler and T J Creteman Courtesy the authors)

covers should be so measured that the top part reaches to the beginning of the gluteal cleft and the lower starts about two inches below the buttocks This will vary somewhat according to the size and age of the patient Occasionally frame covers are made with an oval opening at this level This type of frame cover is usually placed upon boxes to keep it six to ten inches above the bed, to facilitate the use of the bed pan The division in the frame cover is commonly filled in with a canvas strip to keep the buttocks from sagging This strip is, of course, removed when the bedpan is being used Some authorities prefer that the frame remain flat on the bed and be lifted only at such times as the patient needs the pan Still others object to any type of divided frame cover These latter believe that the inevitable sagging of the buttocks at the opening destroys much of the hyperextension for which the frame was prescribed Surgeons who dislike the divided frame cover usually advise a low, tapering bedpan, which elevates the buttocks a minimal amount, and advise the use of a urinal of one type or another when possible

Some doctors request that thick pads of felt be sewed to the frame at the gibbus level These are placed parallel to each other on either side of the spinous processes They are about five to eight inches in length and at least one inch in thickness Such felt pads will fix the spine more securely and also serve to protect the gibbus from pressure

Patients with tuberculous joints should have close observation during the daily bath The general nutrition of the body should be observed, as well as the condition of the skin Pressure areas on bony prominences should be noted These will be likely to show up on the thin patient over the ilia and chin if traction is being applied to these points, and on the sacrum, the gibbus (knuckle) of the spine, the scapulae, the occiput, and the heels posteriorly Any signs of fullness or any heretofore un noticed fluctuating mass should have the immediate attention of the doctor, as they may indicate abscess formation It is particularly im portant to notice such fullness in the groin, where abscesses from the lower spine frequently make their appearance Tuberculous abscesses tend to follow the path of least resistance, and in this case the path of least resistance is along the plane of the psoas muscle, which has its origin on the bodies of the lower six vertebrae of the spine and its inser tion near the lesser trochanter of the femur, which, of course, lies within the groin area Tuberculous abscesses do not manifest themselves in heat and redness and, for that reason, are often overlooked by the nurse

Local rest can be accomplished in a number of ways, and each orthopedist has a particular apparatus he prefers It may be a curved Bradford (Whitman) frame with traction applied to head and pelvis, it may be a plaster jacket applied from shoulders to hip, or sometimes including the legs to the knee, or it may be a bivalved plaster bed of some type, extending from occiput to knees, but divided into an anterior and a posterior section to permit of care and sunlight to the patient's skin The aim of all this apparatus is rest—'Rest, uninterrupted, enforced and prolonged,' a trilogy of treatment promulgated many decades ago by a great orthopedist, Hugh Owen Thomas, of Liverpool In tuberculosis of the spine, even in this era of early mobilization, such unqualified rest is considered to be essential



Fig 167—Whitman frame frequently called curved Bradford frame Note sand bags under apex of curve for further support

The care of the patient in the hospital and later in the home will vary somewhat according to his type of apparatus Hyperextension frames have been in use in the treatment of Pott s disease for many years With the use of the Whitman (curved Bradford) frame in tuberculosis of the spine, it is usually considered advisable to use a divided frame cover that is one in which a section has been cut out at the buttock region for the use of the bedpan If this is so the canvas frame

covers should be so measured that the top part reaches to the beginning of the gluteal cleft and the lower starts about two inches below the buttocks. This will vary somewhat according to the size and age of the patient. Occasionally frame covers are made with an oval opening at this level. This type of frame cover is usually placed upon boxes to keep it six to ten inches above the bed, to facilitate the use of the bed pan. The division in the frame cover is commonly filled in with a canvas strip to keep the buttocks from sagging. This strip is, of course, removed when the bedpan is being used. Some authorities prefer that the frame remain flat on the bed and be lifted only at such times as the patient needs the pan. Still others object to any type of divided frame cover. These latter believe that the inevitable sagging of the buttocks at the opening destroys much of the hyperextension for which the frame was prescribed. Surgeons who dislike the divided frame cover usually advise a low, tapering bedpan which elevates the buttocks a minimal amount, and advise the use of a urinal of one type or another when possible.

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The bath of the child on the Whitman frame follows the general manner of procedure for orthopedic patients He is bathed on the anterior surface of his body first, and the frame is moved to one side of the bed The undersheet is then changed from the opposite side flush with the frame If the child is wearing head and pelvic traction, permission to remove the girdle and chin strap must be given by the doctor He will usually give this permission but urge that traction be off only for the period absolutely necessary for adequate care to the patient's skin Under no circumstances should the nurse leave the bedside while traction is off her tuberculous spine patient, and she must be careful that the patient's position is maintained as accurately as it is when he is in traction Whereas in the care of the scoliotic patient much liberty may be allowed in this matter, it is well to remember that in tuberculosis of the spine one is dealing with diseased and collapsing vertebra, in scoliosis, with a deformity of long standing in which no active disease process is present

If the involvement is severe, the surgeon may feel it wise that such traction equipment be removed only momentarily during the turning process and will ask that manual traction be exerted at that time, this can be done by two nurses, one of whom exerts gentle pull on the shoulder girdle while the second nurse exerts traction by her grasp on the child's pelvis When the child is turned, the girdle and weights are reapplied and the foot of the bed is elevated to provide countertraction in the absence of the chin halter

In turning the tuberculous spine patient, several methods may be employed. A concave frame may be used to cover the child's body, with a hole cut out of the cover for feet and head The two frames are strapped together, and the child is carefully turned so that he lies face downward on a concave surface This device insures almost complete immobility

During the past few years, it has been found that the Foster bed or Stryker frame may be used to provide immobilization for the patient with a tuberculous spine These frames, attached to a turning device, provide more adequate immobilization and make it possible for one nurse to turn an adult patient Special frames which may be hyperextended to meet the individual patient's needs are available This type of apparatus, which facilitates turning the patient, is especially desirable following surgical fusion of the spine The care of the patient on the Foster frame is described later

In any method of turning patients in frames, the patient should be taught how to stiffen himself He may, if he is young, need a little practice at this, but once having learned the trick, he will be your best assistant With his body rigid and pokerlike, the child will be much less likely to sag or twist as he is turned *Twisting is to be avoided at the shoulder or pelvic girdle or buttocks just as much as it is in the spine itself* Movement of those parts causes motion between the vertebrae of certain sections of the spine



Fig 168 —Turning child from curved frame Note pillows in readiness for supporting chest and thighs to preserve hyperextension of spine as the child lies prone

A very small child can be turned by one nurse, who, flexing her elbows, secures the chest and thighs of the child with her forearms as she turns the frame toward her There is, however, definite danger of the legs sagging toward the bed as the patient is turned when this method is employed

A much more accurate turning of a young child may be accomplished by two nurses With the frame pulled to the opposite side of the bed, these two nurses grasp the child's body at the shoulders and hips The

nurse at the shoulder level faces the nurse at the hip level Her hands firmly grasp the shoulders of the stiffened child The nurse at the hip level has her fingers over the posterior surface of the pelvis, her thumbs grasping the iliac crests and her forearms steadying his body on either side All movement must be simultaneous, firm, and unhurried as the child is turned toward the nurses To maintain the same amount of hyperextension that the child had on the curved frame, pillows are ready for his thighs and chest Caution should be observed here the placing of these pillows must be very accurate or the child's position will be radically changed as he lies prone, if too close together, there will be no hyperextension possible, if too far apart, the head and feet alone will be elevated, and no appreciable hyperextension of the spine will occur

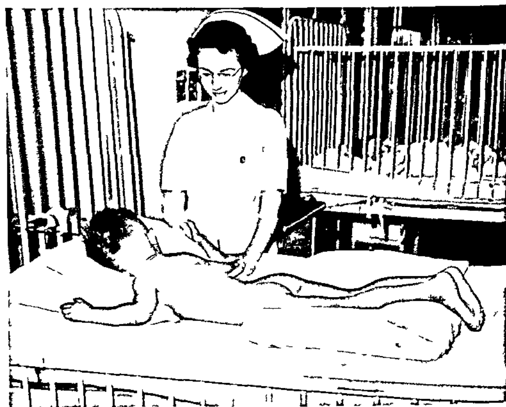


Fig 169 —Patient with tuberculosis of the spine turned from frame for posterior bath Not a safe position for long periods

Needless to say, this prone position is not one of security The child tends to move about more than is permissible unless very closely restrained or watched For a larger child, three or four nurses may be necessary to accomplish the above procedure If the frame is suspended

on hooks or elevated on boxes, it should be lowered to the bed before turning is begun It is hardly necessary to emphasize that these patients need the most careful support of their feet when lying in either position Remember the long recumbency combined with the constitutional nature of the disease will predispose the patient to grave foot disorders if proper attention to their support is not given during this time

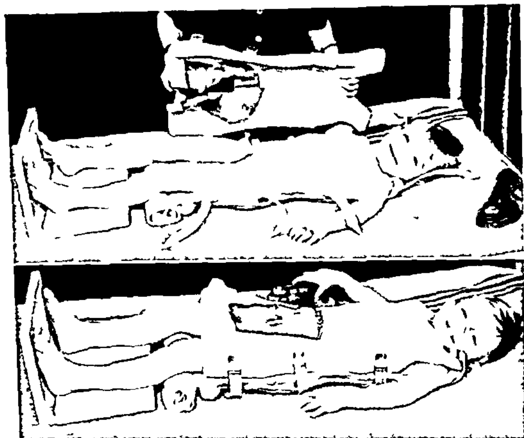


Fig 170 —The plaster shell or plaster bed is frequently used to immobilize the spine following fusion Each half is lined with stockinette The straps and buckles make it possible to remove either half for bathing and skin care Before the patient is turned the straps are buckled tightly (Courtesy Iowa State Services for Crippled Children)

Care to the patient's back is important If he is thin and emaciated, pressure areas will demand close attention The gibbus, or knuckling that occurs at the level of the diseased vertebra, is often the site of severe pressure areas Since the patient lies on this spot over so long a period, it can readily be understood why this pressure necrosis occurs Occasionally a bursa will have formed on this gibbus, and it may be hot and in

durated Hot wet dressings are sometimes ordered If this is done, care must be taken to protect the frame at this level with some type of water proof material

If no inflammation is present, a good massage may be given, working outward from the gibbus, using cocoa butter, lanolin, or alcohol A semi circle of felt of sufficient thickness to extend beyond the gibbus may be secured to the skin with narrow strips of adhesive (avoiding the gibbus area) and will do a great deal to overcome this tendency toward serious decubitus Care to the back should always include the back of the head, so often a point of denudation and pressure Remember in all ministra tions to this patient that any motion between the diseased vertebrae may break down precious granulations and deposits of calcium which have taken weeks to form

Children with tuberculous spines should be fed This should be done, in the first place, because feeding oneself in so complete a state of re cumbency is a fatiguing business, and tuberculosis is one disease where fatigue is to be avoided at all costs The fatigue incident upon feeding himself often causes the tuberculous child to eat less than he needs, and in this way double damage is done The child should be fed slowly, with careful observations of his eating habits His diet, being carefully planned for high caloric intake, high protein and vitamin content, should be urged firmly, but understanding of the child s capacity should aid the nurse to use her discrimination in judging when he has had sufficient An in between meal nourishment should be always included in the tuberculous child's diet, and it should be planned to be nutritious without filling him to such an extent that he will not be able to take his next meal Milk should be rich, and plentiful, and the child must not be allowed to develop finicky habits incident to his dislike of certain vegetables and other wholesome foods A child who is responding well to treatment may be allowed to feed himself his dessert if he can do so conveniently

Restraints are a matter of great importance in the nursing care of children afflicted with Pott's disease They must be efficient in maintain ing the position of hyperextension prescribed by the doctor, but on the other hand, they must inflict no unnecessary restraint upon the child In tuberculosis of the lower dorsal and lumbar spine it is frequently nec essary to restrain the child s feet by some loose bands around the ankles secured to the frame *However, this is seldom necessary in tuberculosis* of the upper spine, and, as has been stated, any unnecessary curtailment of activity for the child is to be avoided Restraints to maintain posi

tion on the frame may be of the vest or jacket variety, in which a garment for the upper part of the body made with canvas is equipped with webbing straps and buckles attached at the back of the neck and thence to the upper part of the bed. Straps at the level of the waist and chest may be secured around the frame with buckles. Another type of restraint may be made entirely of webbing straps about one inch in width. This consists of a Y shaped apparatus, the two upper arms attached to the top of the frame, the lower arm attaching to the center of the foot piece of the frame. This is augmented with three cross straps affixed at different levels, one at the chest, one at the waist, and one just below the hips. All straps have buckles and they are fastened beneath the frame.



Fig. 171.—Prone position. The anterior and posterior halves may be buckled in place to prevent the child from rising up and turning. Note the waterproof material placed about the perineum and buttocks. (Courtesy Iowa State Service for Crippled Children.)

This type of restraint is advantageous in that it allows more exposure of the skin for sunlight treatment. Another type of restraint which has proved very efficacious is the so called Carrell frame. It is made of iron rod about ¼ inch in diameter, covered with rubber tubing. It fits over the shoulders, trunk, and upper thighs of the patient in such fashion that the child is restrained without the apparatus actually touching his skin at any place. It can be used with the child lying prone or supine and is attached to the Bradford frame with a fixation device at the upper bar of the frame by means of a swivel arrangement. An aluminum frame, resembling a cradle, which fits over the child's trunk is used in some hospitals. It is a simple device and easy to keep clean. A disadvantage of the last two named types of restraints is that they must be made individually for each patient.

Clothing for these patients must be simple and easily removed. Nothing which slips over head or feet should be tolerated, as these are bound

to disturb the immobilization which is so necessary for recovery in this disease. Only open gowns or dresses should be used, but variety may be introduced here by the use of color in making such garments.

Since the chronicity of this disease is one of its most outstanding features, early consideration must be given to the education of the child. We know that of late years educational methods have been adapted very satisfactorily to bedside teaching, so that the long treatment required by this disease does not need to break into the child's progress through school. Most communities have arrangements made wherein such children are given the advantage of a specially arranged plan of study to suit their needs. The child should not lose the interests common to his age, nor must he face a future wherein he is forced to return to school at a much lower level than his age justifies.

Occupational and diversional therapy are most important. Reading Rollier's article, "Heliotherapy," the reader must be impressed with the amount of stress he lays upon occupational therapy for his patients, indeed, he points out that in omitting it much of the value of his course of treatment would be negated. Limitation of activity with these patients, of course, has to be considered, both from the fact that the child's position is such that many occupations are impossible for him, and also because fatigue must be avoided. However, such individuals can be taught many useful crafts and be permitted to enjoy these during certain periods of the day. Many inclinations are developed and many natural gifts and talents discovered that may play an important part in the patient's future rehabilitation. Because of the unnatural position employed in reading and handwork, the possibility of eyestrain should always be a matter for consideration. Lighting must be carefully supervised.

SURGERY IN SKELETAL TUBERCULOSIS

Surgery may be done on the patient with skeletal tuberculosis for one of several reasons. (1) Biopsy for diagnostic purposes. With the present day use of antibiotics, this procedure can be performed with little danger to the patient and, since drugs used in the treatment of tuberculosis of bone and joint are more effective in the early stages of the disease, it is imperative that a diagnosis be made as soon as possible. (2) To obliterate joint motion by surgical interference, the operation being called an arthrodesis. This is by far the most common type of operation on tuberculous joints encountered on the orthopedic ward. (3) For evacuation and drainage of an abscess. (4) A decompression

operation may sometimes be necessary when an accumulation of pus has invaded parts of the body which contain vital organs, as may happen when the spinal cord is compressed by inflammatory exudates (5) Surgery may also be done on tuberculous patients to correct an existing deformity Osteotomies are common in this last group

Care of the patient after spinal fusion has been described in another chapter Joints which have undergone arthrodeses are usually well immobilized in plaster of Paris before the patients are returned from the operating room, and their nursing care is that of any surgical patient wearing a plaster cast However, *the systemic nature of the disease which has made the operation necessary should never be lost from the nurse's mind* Laminectomy for decompression of the cord will not vary greatly in its care from the spinal fusion operation

NURSING CARE OF AMBULATORY PATIENT

When the patient's period of recumbency is over, and healing and calcification have progressed to such an extent that the orthopedist in charge feels he may be allowed up for short periods with some type of ambulatory support, a new set of duties supervenes for the nurse Limitations of time designated by the doctor must be rigidly adhered to Too often the ambulatory patient on the busy orthopedic ward is forgotten in the rush to care for a patient more seriously ill Periods of activity for the newly released tuberculous patient should never be prolonged or vigorous during the first weeks Insistence on rest must be as unalterable as it was when he lay on a frame Appetite must be observed lest it start falling off, due to fatigue from overactivity, and weight check should continue to be done weekly Evidences of any loss of ground on the part of the ambulatory patient should be reported to the physician The same observations for beginning abscess or pressure sites are as necessary as they were during the period of recumbency

The type of support may be an ambulatory cast, jacket, or brace Commonly used in Pott's disease is the Taylor body brace The Taylor body brace, or modifications of it, is in common use in most hospitals It consists of two thin, flexible steel bars which form a support for the vertebral column lying one on either side of it, and fitting the curves of the back perfectly A pelvic band is fastened at the bottom of these supports, being made of steel and leather Another crossbar attaches at the scapular level Straps fastened to the vertical bars go over the shoulders, under the axillae, and return to their original attachment,

making a sort of loop In the front a canvas apron supports the chest and abdomen and is fastened to the brace itself by tape webbing straps and buckles These secure the brace tightly to the chest and abdomen It should always be remembered by the nurse applying these braces that the pelvic band must closely encircle the pelvis slightly below the iliac crests If this is done, the brace will be in the proper position as regards the rest of the body Whatever the type of body brace used, both brace maker and physician advise that you fasten the brace around the pelvis first if the patient is lying down, as should always be the case in tuberculosis

COMPLICATIONS IN TUBERCULOSIS OF THE JOINTS

The symptomatology of complications in tuberculosis of the joints should be known to the orthopedic nurse The most frequent causes of death are given by Steindler as meningitis in the child and recrudescent tuberculosis of the lungs in the adult Chronic reasonless irritability in the young child who has tuberculosis of a joint should be a point of observation on the part of the nurse Symptoms of this nature may occur many weeks before evidences of lethargy, headache, neck rigidity, or convulsive states are manifested Rapid loss of weight in the adult severe night sweats, temperature elevation, anorexia, and debility may indicate oncoming miliary tuberculosis

Steindler states that tuberculosis of the kidney occurs more often with bone tuberculosis than in the pulmonary disease Renal complications may be manifested in urinary disturbances cystitis, hematuria, and the like An accurate measurement of intake and output is indicated for the tuberculous patient in whom this sort of complication is suspected, and periodic urinalyses are usually ordered by the doctor Gastrointestinal upsets distention, constipation, and nausea, while they may be the result of retentive or reclination apparatus, should be reported if they become obstinate or persist over a long period In this connection it might be well to mention here that retropharyngeal abscess complicating tuberculosis of the cervical spine is often manifested by dysphagia or dyspnea These symptoms have special significance and must be reported as soon as observed Spasm of the muscles of the thigh and a tendency to flexion and lateral rotation of the limb which is accompanied by great pain on motion may suggest to the doctor that a psoas abscess is in the process of formation long before a fluctuating mass may be seen in the groin

Sudden weakness or trembling of the legs may be the first indication of further breakdown in the affected vertebrae It is a very grave symptom, often a forerunner of paralysis, and must be reported to the physician in charge without delay

Home Care for Patients With Tuberculosis of Bones and Joints—Of what do instructions for home care of these patients consist?

Parents must first be taught what to observe and then be instructed in the interpretation of their observations Second, they must be given a definite idea of the principles which underlie all details of the management of the child at home, and, last, they must be instructed carefully in the technique of carrying out these details This third consideration will most frequently be delegated to the nurse

The doctor will often instruct the parents that it is necessary to keep a daily record of temperature, to observe and estimate the amount of food intake, rest and sunlight which the child is given He will instruct *them in the importance of recognizing any loss of ground* as regards either weight or general strength, for signs of setback in these patients often occur so gradually that only by impressing firmly upon the parent s mind the necessity for solicitous observation and the most painstaking care, will the patient's future welfare be assured

Where the doctor knows without question that the status of the family income will not permit of proper care for this patient, social agencies will be consulted and community resources called upon Some doctors feel quite strongly that because of the protracted character of the disease, its tedious course, and the great likelihood of complicating factors and recurrences, the patient should be cared for institutionally until solidification of the joint and quiescence of the disease are assured

For effective instruction as to home treatment the nurse should, if possible, employ the demonstration method, demonstration of bath, care of cast or traction and frame must be given if her instructions are to have any carrying power at all with the parent She must have enough imagination, too, to understand how the home situation will vary from the hospital situation and to suggest means of improvising where equipment will manifestly be lacking Ability to compute a satisfactory diet for the tuberculous patient which takes into consideration the family income is another important feature Methods of handling the indispensable sunbaths must be suggested, a not too easy task if the parents do not live on the ground floor Many little details that seem almost too small to be mentioned must be gone into thoroughly in relation to the home treatment of the tuberculous patient It is not enough, for

instance, to advise the family to see that the individual gets "plenty of sun" Observation has shown that the child will come back to the clinic with his face and hands nicely pigmented, but his body will be white as a lily because the parents did not understand his whole body was to be included in the sun treatment Rest periods tend to be curtailed in the home, and substitutions made for essential foods because *the parent thought the substitute "just as good"*

Instructions will vary with each individual case, but whatever the instructions are, they must be given kindly, with an understanding of the magnitude of the problem which confronts the confused parent, and with a genuine desire to help him solve his problems No greater nursing service is possible than such teaching, when one considers the large proportion of home care usually given such patients during the course of their disease In addition to instructing the patient or parent, the hospital nurse will make a referral to the local visiting or public health nurse Since most of these patients are instructed to continue with chemotherapy at home, it is essential that a visiting nurse make home visits, administer the drug intramuscularly, and evaluate symptoms and progress

QUESTIONS FOR STUDY—UNIT V

1 How has the use of antibiotics changed the treatment and nursing care of the patient with osteomyelitis?

2 Describe precautions you will take when dressing a draining wound

a To protect the patient

b To protect other patients in same ward

c To protect yourself

3 What will you teach the patient regarding the dressing of his wound?

4 Describe the method of handling an acutely inflamed joint that will cause the least pain

5 Discuss the importance of early diagnosis and treatment of active pulmonary tuberculosis as it relates to the prevention of bone and joint tuberculosis

6 Discuss the treatment and care of a child with a tuberculous spine

a General health measures and treatment

b Specific treatment and nursing care pertaining to the spine

c Teaching of patient and family

7 For what particular complications should the nurse caring for a patient with skeletal tuberculosis be on the alert? What are the symptoms of such complications?

8 Define the following terms

Brodie s abscess cold abscess ankylosis, arthrodesis, fusion, gibbus involucrum kyphos, night cries, saucerization, and sequestrum

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Unit VI
METABOLIC DISORDERS OF BONE

Chapter 15
METABOLIC DISORDERS OF BONE

BONE METABOLISM

To understand metabolic disorders of bone, a brief discussion of factors controlling normal bone metabolism is necessary This discussion will include its constituents, its normal metabolism, and its abnormal metabolism

Constituents —The constituents of bone are the following

A Water, which makes up 75 per cent of the bone at birth and 15 per cent of bone in adult

B Solids Matrix, the ground substance of bone, composed of complex proteins laid down by osteoblasts (cells which produce bone)

C Chemicals Calcium and phosphorus, made up mostly of calcium phosphate 80 per cent, calcium carbonate 13 per cent, and magnesium phosphate 2 per cent These chemicals are deposited in the matrix of bone to give it rigidity and thus make it strong It is important to note here that bone is constantly made in amount necessary to resist stress When stress is lacking, bone resorption will take place by the action of cells called osteoclasts The calcium and phosphorus of bone structure comes from foods ingested and absorbed through the gastrointestinal tract Milk and milk products are the best sources of calcium The acid medium of the upper gastrointestinal tract along with the adequate presence of vitamin D, is most favorable to its absorption The vitamin D does not necessarily need to be ingested since the body is capable of synthesizing it if exposed to sufficient sunlight The actual deposition of calcium and phosphorus is complicated and not completely understood, but it is certainly aided by the enzyme systems and follows certain chemical laws

The amount of calcium circulating in the blood serum maintains a constant level which is somewhat regulated by the parathyroid hormone. The calcium is then carried to the bone by the blood serum and is deposited in the protein bone matrix which forms its solid portion. The calcium and phosphorus necessary to bone metabolism have another role in bone and body chemistry, namely, regulation of acid base balance.

In kidney disease where acidosis may exist, the calcium and phosphorus are excreted in more than normal amounts in order to control acidosis. In such circumstances, the bone, itself, is depleted of its calcium in order to maintain the most important calcium phosphorus equilibrium. By testing the amount of calcium and phosphorus in the blood serum, and the amount of calcium excreted in the urine, it is possible to get some idea of the abnormalities in bone metabolism.

Abnormal Bone Metabolism.—Any interference with the normal regulatory mechanisms of intake, absorption, utilization, or excretion of calcium can lead to metabolic bone disorders. The diseases caused by altered bone metabolism can be divided into two general groups:

1. Lack of mineralization of bone, which can be the result of:
   - A. Insufficient intake of calcium, phosphorus, or vitamin D
   - B. Insufficient absorption of calcium, phosphorus, or vitamin D
   - C. Insufficient utilization of calcium, phosphorus, or vitamin D
2. Demineralization of bone, which can be subdivided into:
   - A. Excessive amounts of hormones affecting calcium and phosphorus, such as parathyroid, thyroid, and sex hormones
   - B. Chronic acidosis or ketosis—kidney dysfunction
   - C. Malignant disease affecting bone
   - D. Atrophy of disuse or immobilization of bone

RICKETS

Rickets is a bone disease of childhood due to an insufficient amount of calcium available for deposit in bone. It can be caused by inadequate intake in the diet but more commonly is the result of inadequate vitamin D. Vitamin D is necessary for proper calcium absorption from the intestine and also is needed to aid in the deposition of calcium in the bone.

This disorder leads to soft bones which deform if not checked and will also interfer with growth. The treatment is to provide adequate intake of calcium and vitamin D. (Fig. 172.)

"Resistant" rickets is due to a defect in the utilization of vitamin D and will require more than normal amounts of vitamin D intake to control calcification of bone



Fig 172—Bowlegs (genu varum) which are the result of active rickets If the rickets is brought under control the bowlegs will correct themselves by further growth

OSTEOMALACIA

Osteomalacia is identical with rickets but occurs in adults and therefore does not result in dwarfism and does not show such marked deformities The commonest deficiency is inadequate intake of calcium *and occasionally it results from poor absorption in individuals who have* steatorrhea It can occur after repeated pregnancies if the intake of calcium has not been equal to the increased need of calcium for the growth of the fetus

RENAL RICKETS

In kidney dysfunction bone can be demineralized as a result of calcium being drawn from the bone reservoir to bolster any drop in serum calcium This occurs when the calcium and phosphorus of the serum must be utilized to regulate the acid base equilibrium through urinary excretion

There are several types of renal rickets dependent upon the specific kidney dysfunction, such as Toni Fanconi nephrotic glycosuric rachitic syndrome, cystine rickets, and rickets with nephrosclerosis The treatment of this entire group depends upon the control of the kidney dysfunction (Fig 173)



Fig 173—Fanconi syndrome This patient in the early thirties shows deformities of the legs and the dwarfing that occurs in metabolic bone disease where the primary fault is in the kidney

HYPERPARATHYROIDISM

A hormone from the parathyroid gland has a regulatory effect on the amount of circulating calcium in the blood serum It acts to maintain a constant level of serum calcium, but the serum calcium rises when an

excessive amount of parahormone is present This constitutes hyperparathyroidism and is found associated usually with tumors of the parathyroid

If the condition is allowed to go on indefinitely, the kidneys suffer because they are called upon to excrete more calcium than normally, and kidney stones are frequent Calcium is drained from the body stores namely bone, to make up for excessive loss of calcium in the urine, and this can become so marked that cysts are formed in the bones Osteitis fibrosa cystica is a term sometimes used to describe the syndrome of hyperparathyroidism The treatment is removal of the parathyroid tumor

PAGET S DISEASE

(Osteitis Deformans)

This is a disease of the bone in which there is overactivity of osteoblasts and osteoclasts, building and destroying bone, with an unaltered chemical pattern High levels of phosphatase occur and are an index to the rapidity and amount of new bone being formed The cause of this disease is entirely unknown, and the treatment therefore is limited to the correction of deformities which occur People afflicted with this disease are usually past middle life and the bones involved may be few or many

The bones become broader and weaker than normal and are easily fractured The fractures heal readily In the generalized form it is well known in this disease that the sufferer grows shorter in height and, because the skull expands, may require a larger size of hat In rare instances the involved bone may show malignant changes

HYPERVITAMINOSIS D

This condition, which is due purely to an excessive intake of vitamin D, is included here to warn and to point out that excessive doses of vitamin D can cause harmful chemical changes related to calcium and phosphorus metabolism Serum calcium is increased and calcium deposits in the soft tissues occur The kidneys can be irreparably damaged by calcific deposits and also must excrete large amounts of calcium in the urine The treatment is to lower the vitamin D dosage

OSTEOPOROSIS

Porous bone refers to bones that show demineralization This condition can be due to various causes, the more common of which will be mentioned briefly

A Disuse —Normally, the trabeculae of the bone withstand the stresses placed upon them as in bearing weight and muscular activity The bone grows and mineralizes to withstand the demands placed upon it, and this accounts for the fact that a football player grows a thicker and more dense tibia than a person less active Should these stresses be removed by a sedentary life or prolonged bed rest for the treatment of a chronic ailment, the bones respond by becoming less calcified and will show thinner cortices At times the loss of bone substance can be great, as following prolonged immobilization in a plaster cast This is known as the atrophy of disuse, a form of osteoporosis



Fig 174 —Osteoporosis This is a metabolic disorder of elderly persons (females especially) where calcium in the bone is depleted and in addition the bone matrix fails to produce replacement bone The result is a weakening of the structure

B Senile Osteoporosis —In advanced age the daily replacement of bone may not keep pace with the wearing out process The bones in this instance will appear washed out in an x ray film and the condition can be referred to as osteoporosis The exact mechanism that allows this to happen is not entirely clear but could well be a part of general slowing of metabolic processes, particularly pertaining to the metabolism of protein which is necessary in bone There is no treatment other than

excessive amount of parahormone is present This constitutes hyper parathyroidism and is found associated usually with tumors of the para thyroid

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to improve protein, calcium, and vitamin D intake and to increase activity of the patient with the idea that stress will stimulate bone formation (Fig 174)

C Postmenopausal Osteoporosis—The incidence of osteoporosis in females five to ten years beyond the menopause is common enough for this group to have been given special consideration This is in part due to the fact that this group will respond to hormone therapy Studies have indicated that lack of estrogenic hormones has an effect on protein and calcium metabolism to such an extent that osteoporosis of rather severe degree can result The resultant weakening of bone is apt to be greatest in the vertebral bodies, and it is common for these to collapse under normal stresses When collapse occurs, the spine becomes painful The treatment is identical with that for senile osteoporosis, with the addition of estrogenic hormones

become further fixed by scar tissue and bone After the bone has ankylosed, the pain leaves but the patient is still disabled because the joint will not function and remains fixed in a position of deformity The process of fixation may occur slowly over a period of years, and, on the other hand, it is only wise to point out that many cases become arrested spontaneously before deformities or ankylosis occurs



Fig 175 —Marie Strumpell arthritis Typical posture in ankylosing arthritis of the spine Hip and shoulder joints may also be involved (From Smith Petersen M N Larson C B and Aufranc O E Osteotomy of the Spine for Correction of Flexion Deformity in Rheumatoid Arthritis J Bone & Joint Surg 27 Jan 1945)

Treatment of rheumatoid arthritis has made advances in recent years Drugs such as ACTH and cortisone, which are prepared extracts from the pituitary and adrenal glands respectively, have a definite effect in reducing the pain and acute inflammation present These drugs are not

Unit VII
ARTHRITIS

Chapter 16
ARTHRITIS

The term arthritis means inflammation of a joint Patients are fearful of the word arthritis because it carries the connotation of severe crippling of all the joints It is essential that nurses, as well as doctors, have a clear understanding of the types of joint disease so they can use proper terms of diagnosis and avoid the improper implications of the word arthritis There are three main types of arthritis that are recognized as clear entities and, because the outcome of each type is different, it is important to have an understanding of each type

1 RHEUMATOID ARTHRITIS

(Atrophic Arthritis)

Rheumatoid arthritis is a generalized disease which produces constitutional symptoms as well as changes in the joints of the body that lead to severe crippling It attacks any age group but is most common in the first two decades A characteristic of the disease is that it occurs in cycles of activity and remissions As a result of natural periods of improvement it is difficult to evaluate the effect of various treatments The improvement which occurs naturally is all too frequently ascribed to the prevailing therapy and for this reason many patients have been the victims of cults and faddists

The cause of rheumatoid arthritis is unknown but certainly the disease is aggravated by fatigue, colds overexposure, and emotional crises Once established the disea e produces changes in the joints, one or many often symmetrical that can go on if unchecked to produce deformities and complete loss of motion

Loss of motion is called ankylosis and may be fibrous (scar tissue) or solid bone The outstanding symptom is pain in one or many joints It is persistent aching pain and can be so severe that it is difficult to relieve by medication Any motion in the afflicted joint increases the pain, and for this reason patients fix the joints by muscle spasm and hold them fixed for long periods It is during this time that the joints

Chapter 17

NURSING CARE OF THE PATIENT WITH ARTHRITIS

There are so many terms in the medical nomenclature for describing the very familiar condition known to the nurse merely as "arthritis," that much confusion is likely to exist in her mind as to just what term is preferable Atrophic arthritis, proliferative arthritis, infectious arthritis, polyarthritis, rheumatoid arthritis, arthritis deformans, and, in children, Still s disease, seem to be used interchangeably by doctors Despite the difference in terminology, however, the nurse usually has a clear concept of the disease condition when the word arthritis is mentioned Almost invariably the concept is of a patient afflicted with a chronic condition of the joints, characterized by swelling, deformity, and pain—a patient who is thin, anemic, and irritable, and of all patients in the world probably the most difficult to care for If she is a very young nurse, she may never have seen a patient so afflicted recover to anything approaching normalcy, and her private conviction about the disease is likely to be one of dark pessimism

Yet contrary to her opinion, arthritis is often a curable condition, and intelligent faithful care will in most instances be rewarded by a considerable degree of recovery Intelligent care includes recognition of the systemic nature of the disease as well as of its orthopedic complications, and this is important for the nurse to remember constantly in the care of these patients

Most of us are dimly aware that arthritis is a great cause of chronic disability, but the actual extent to which this is true is hard for us to realize Authorities tell us that rheumatism is second only to mental and nervous conditions as a source of disablement The cost of medical care alone has been given as in excess of $100,000,000 annually Arthritis occurs in all classes of society, but more than half of the total number of days lost from employment was in families with low incomes The incidence of arthritis in low income groups where poor housing and nutrition and economic worry are perpetual factors is too high to be entirely coincidental

Arthritis is a systemic disease, not one of the joints alone This is evidenced by the anemia, the low grade fever, the weight l

curative, however, even though they have a beneficial controlling influence Aspirin or similar compounds are very effective in controlling pain and can be taken for periods of weeks or months, if kept below toxic levels The remainder of the treatment is aimed at improvement of general nutrition, avoidance of fatigue, and local care of the joints The care of the joints in essence is the use of splints to prevent deformity, but most important is maintenance of function If, by controlling pain with drugs, hot packs, paraffin baths, or other means, the patient can keep up active motion in the afflicted parts, he can prevent deterioration of muscles and ankylosis of joints Reconstructive surgery must be undertaken where deformity and ankylosis persist

2 DEGENERATIVE ARTHRITIS

(Hypertrophic Arthritis)

Degenerative arthritis is part of the aging process and, therefore, occurs in people in the latter decades of life This arthritis can be generalized but is more apt to occur in areas most subject to strain, such as knees, hips, and lumbar spine Often the terminal phalanges become painful and deformed, while the remainder of the hand is spared This type of arthritis may produce contractures of joints such as knees or hips, but ankylosis is unlikely The outstanding symptom is pain in the joint, but unlike rheumatoid arthritis the pain can be controlled by rest

There is no treatment that can arrest the process of deterioration, but disability can be held to a minimum by maintaining strong muscles and preventing deformity Most often exercises will accomplish both of these Occasionally reconstructive surgery for hips and knees is helpful in eliminating pain and deformity when conservative measures have failed

3 TRAUMATIC ARTHRITIS

Traumatic arthritis is similar to hypertrophic arthritis with the exception that it is the result of trauma to the joint surfaces and therefore is not confined to older people It can occur at any age but usually occurs in the thirties or later Often it follows in the wake of a fracture where the force causing the fracture is sufficient to damage the joint cartilage The traumatic arthritis is not apparent at the time of injury but follows some months or years later, since damaged joint surfaces will deteriorate more rapidly than an uninjured joint

The treatment is similar to hypertrophic arthritis Since this type of painful joint is apt to occur in middle life and be confined to one joint, reconstructive surgery is more often applicable

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Arthritis is a systemic disease, not one of the joints alone This is evidenced by the anemia, the low grade fever, the weight loss, and other

disturbances of the patient's general health He tends to be psychologically and physically depressed A definite relationship seems to exist between emotional tension, financial or personal insecurity, and the onset of the disease Because of these factors, the treatment is never entirely orthopedic It is always a mistake to focus attention exclusively on the joints, although the condition of his joints is usually the patient's main concern Characteristically, the small joints are attacked first The swelling which appears in the hands is usually present in the proximal interphalangeal joints (middle knuckle) The muscles of the phalanges above and below



Fig 176 —Arthritic hands Note the enlarged metacarpophalangeal joints and the spindle shaped fingers due to swelling of the proximal interphalangeal joints The ulnar deviation of the fingers on the right hand is a common deformity

are usually considerably atrophied, and for this reason the thickened and edematous middle knuckles seem particularly enlarged This deformity is spoken of as spindle deformity, and is quite characteristic In volvement of wrists, knees ankles shoulder and hips may follow if the course of the disease is not checked Certainly patients with even the mildest joint symptoms should have the benefit of early medical attention *But the tendency to wait and see if the pain won t go away* is the reason that arthritis so frequently has a firm hold on the patient before the doctor sees him

GENERAL CONSIDERATIONS IN TREATMENT

The problem of treatment is a very complex one. Provision for adequate rest, local and general, is usually made at once, and this includes attention to the prevention of deformities that sometimes come about by unwise habits of rest. Removal of foci of infection, if present, may be necessary. Blood transfusions are often given in the acute and subacute phases of the disease. Attention to the patient's nutritional deficiencies is important. Physical therapy treatments must be instituted. Last, but not least, the patient must be helped to make the psychological adjustments to his disease and to the factors which seem to contribute toward its progress. Anxiety must be allayed, and causes for worry removed if this is at all possible. The patient must not be allowed to lie in bed worrying about the cost of his hospitalization. Usually, after the acute period, he may be cared for in the home unless orthopedic corrective measures must be carried out.

Intensive vitamin therapy, used in the past with considerable enthusiasm, is now in disrepute. Most of the drugs and vaccines used for arthritis—and they were legion—have been abandoned, although the salicylates continue to be employed extensively for the relief of pain. A method of treatment by gold therapy will be discussed in a later section.

DIET

For many years great emphasis has been placed on the importance of special types of diet in arthritis. Many dietary cults have arisen and flourished for a time, only to be replaced by others when the fad wore out. At the present, it is felt by most authorities that no special diet is necessary, provided the patient has the necessary foods for building up his depleted body needs. Usually emphasis is placed on blood building foods and those high in vitamins and mineral salts. Occasionally a diet high in cellulose and low in carbohydrate will be ordered, as there seems to be some difficulty in the arthritic patient's ability to assimilate carbohydrates.

HELIOTHERAPY

A dry climate of equable temperatures is often recommended for the arthritic patient, but unfortunately this is not often within the reach of his pocketbook. Sunshine, however, is usually available to him, at least for part of the year, wherever he may live. It is an important adjunct to the treatment of the arthritic patient that is often overlooked. We

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the rigid, boardlike abdomen present in cases of acute appendicitis This is another example of the effort of muscles to protect an inflamed area In the case of the inflamed joint, however, it must be borne in mind that permanent contractures may occur from this protective muscle spasm To prevent this from happening, some provision is usually made to provide an *external* splint for the joint, in which it may rest in a good anatomical position Once these external splints—bivalved casts, wire splints, braces, etc —are applied, the necessity for rigid muscle contracture to protect the joint is overcome, and the danger of permanent contracture around joints is eliminated

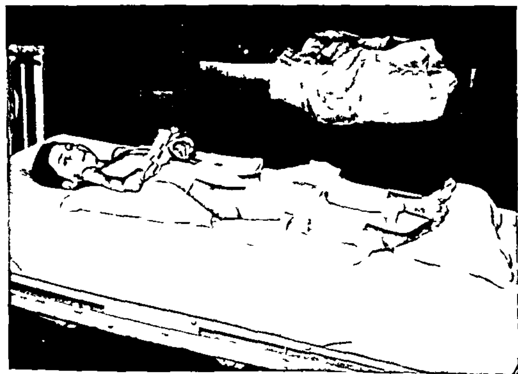


Fig 178 —Rest position with pillow under dorsal spine Adducted position of arms is undesirable for long periods and should be alternated with positions of abduction and external rotation Note night splints applied with Ace bandages

Nurses should understand clearly the purpose of these splints, as well as the reasons why their use may be intermittent Often permission is given to remove them for several hours, and a false sense of their dispensability may occur in the nurse s or in the patient's mind All too frequently carefully made splints are forgotten, or even lost, when the patient returns to his home, and gradual deformity due to increasing muscle spasm around the joint occurs The nurse, by her faithfulness in

have been told that decalcification of the skeleton occurs in this disease, and to some extent heliotherapy might be expected to stimulate calcium metabolism in these patients Furthermore the effect of fresh air and sunlight on the patient s morale is so gratifying that its use for this pur pose alone would be sufficient to recommend it



Fig 177 —Method of maintaining abduction of arms without interfering with activity of hands

REST AND PREVENTION OF DEFORMITY

Rest is so essential in the treatment of the disease that without it any other treatment is likely to be fruitless, but because of the chronic nature of his condition and because he has borne with it so long without going to bed, the tendency of the patient and those who care for him is to over look the importance of rest One authority advises that it be prescribed in definite amounts for definite times, as a drug would be prescribed, so important is this factor to the patient s recovery

Local rest is important, too When a joint is inflamed, the muscles around it contract to protect the joint against movement This contrac tion, or spasm, in the muscles is a protective mechanism of Nature which accompanies many types of inflammation All nurses are familiar with

in a bed position which is almost exactly the opposite of the one they tend to assume for comfort, and to practice deep breathing exercises at regular intervals throughout the day Breathing exercises are encouraged because the characteristic position of the arthritic patient is one in which narrowness of the thoracic cage is extremely pronounced and diaphragmatic excursion very limited The position in which the patient takes



Fig 180 — Coffinlike position frequently assumed by arthritic patients Shoulders adducted elbows and wrists flexed

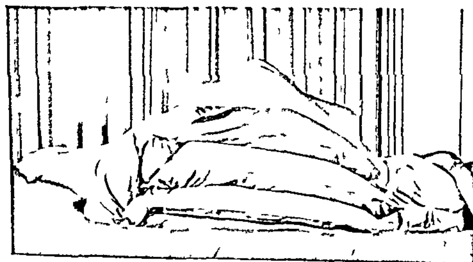


Fig 181 —Permanent flexion contractures of the knees and hips caused by the continuous use of pillows to support the knees in a flexed position A common deformity in arthritis

applying the splints while the patient is in the hospital, and her teaching when he is dismissed can increase the respect of parent and patient for his apparatus

The tendency of the arthritic patient to assume attitudes of flexion and adduction is characteristic of the disease Many of the common de formities result from these positions and are brought about by the well meaning efforts of attendants to make the patient comfortable in bed

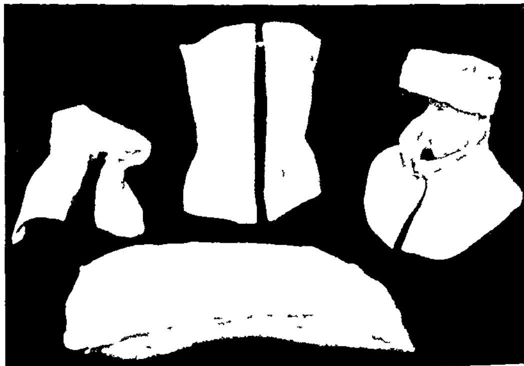


Fig 179—Removable plaster supports used in arthritis for prevention of de formity (From Nursing in Arthritis by Loring T Swain the American Journal of Nursing)

Pillows are placed under the knees because they relax the joint Pillows are bunched up under the head so that the patient may see around him, or the patient rests in a side lying position wherein the body is doubled up, with the chin forward on the chest the shoulders and hips sagging, and the chest concave and sunken All these positions contribute toward the common deformities of arthritis the adducted and flexed hips, the flexed knees the adducted shoulders flexed elbows, flexed wrists with ulnar deviation, the caved in chest and the drop feet

As a prophylactic or corrective measure against these deformities, physicians will usually order arthritic patients to spend considerable time

in a bed position which is almost exactly the opposite of the one they tend to assume for comfort, and to practice deep breathing exercises at regular intervals throughout the day Breathing exercises are encouraged because the characteristic position of the arthritic patient is one in which narrowness of the thoracic cage is extremely pronounced and diaphragmatic excursion very limited The position in which the patient takes



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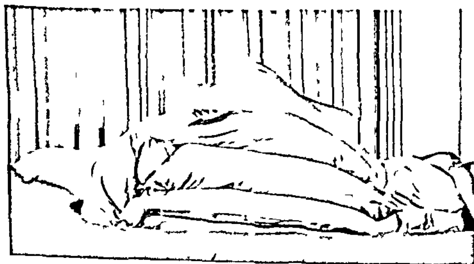


Fig 181 —Permanent flexion contractures of the knees and hips caused by the continuous use of pillows to support the knees in a flexed position A common deformity in arthritis

his breathing exercises is important. It is a back lying position of hyperextension. The pillow extends from the lower border of the ribs to the neck, while the head and hips rest on the bed (a firm, unsagging bed). The patient's hands are placed under his head, and the elbows approximate the bed as nearly as possible (not always easy even in normal individuals). Pillows are allowed under the knees during this period. This attitude may not be obtainable at once, but it is one to be worked for. It provides expansion for the thorax, it stretches out the costal angle, and it lifts the diaphragm. It is routine in some institutions to have patients assume this position for a half hour three times daily, preferably after meals. Prone lying is also recommended, with a pillow under the abdomen only. This is particularly advised for beginning hip contractures. Bed position and wheel chair posture should be carefully supervised at other times, too, that habits established during exercise periods may carry over into daily living. Light braces or specially prescribed corsets may be needed until the patient can develop ability to support his own body.

HORMONE THERAPY

During the past few years, several hormones have been used in the treatment of arthritis with varying degrees of success. ACTH, adrenocorticotropic, a hormone which has a stimulating effect upon the adrenals, is secreted by the anterior pituitary gland. Cortisone is a hormone secreted by the adrenal cortex, and is prepared for oral administration or intramuscular injection. These hormones, in many instances, have been successful in relieving or diminishing arthritic joint pains, thus enabling the patient to have a greater range of joint motion and in general a feeling of well being. However, as the drug is decreased or discontinued many arthritic patients experience recurrence of pain. When administering these drugs, the nurse must realize that toxic reactions are not uncommon and include mental changes, moon face appearance, acne, amenorrhea, weight gain due to edema, high blood pressure and development of hirsutism. Patients receiving cortisone are weighed daily, and a low salt diet and a diuretic may be ordered to help prevent the weight gain. In addition, these patients need to be informed of the possible toxic reactions and the necessity of diminishing or discontinuing the drug completely. If surgery is performed on the individual receiving one of these hormones, it is important that the drug be continued throughout the postoperative period. Close medical supervision is essential.

Hydrocortisone, a hormonal substance secreted by the adrenal cortex, may be injected directly into the articular space, and can be used without fear of the systemic reactions. It frequently relieves joint pain, decreases swelling and tenderness, and thus makes an increased range of joint motion possible. The beneficial effects vary from patient to patient, however, if exercise can be performed, the possibility of joint contractures is markedly decreased. The length of time that this drug is effective varies greatly between individuals.

CHRYSOTHERAPY

The use of gold preparations for patients with arthritis is thought by some physicians to be exceedingly promising. However, it is still considered to be a somewhat hazardous treatment and is always used with caution. The action of gold on the human body is still imperfectly understood, but it seems in many instances markedly to arrest or diminish inflammatory processes in the joints. Patients receiving the drug often improve generally, as well, they are stronger, less depressed, and eat and sleep better.

Preparations which may be used are thioglucose in oil, aurothioglycanide, gold sodium thiosulfate, and gold sodium thiomalate. The usual dose is 25 to 50 mg. per week and it is given intramuscularly. A course of gold therapy may extend to twenty weeks or longer, after which the patient rests for six to eight weeks. A second course may then be given.

The nurse, patient, and family should be well aware of the possible toxic reactions which this drug may occasion. Reactions are exceedingly varied, but no symptom of any kind should be neglected in the patient receiving gold therapy. Toxic reactions to watch for are: skin rash, pruritus, urticaria, soreness of mouth or gums, metallic taste, digestive disturbances, jaundice, purpura, disturbances of the conjunctiva, albumin or blood in the urine. Since doses are given only once a week, the tendency may be to observe the patient on the day he has received his injection, and then to consider him out of danger. Observation should be constant while he is undergoing the course of treatment.

There is no way to anticipate which patient will have such reactions or at what point of his treatment he will develop them. Constant vigilance is therefore imperative. Some physicians will administer vitamin B, liver extract, fruit juice, or other substances to eliminate some of the unpleasant effects of gold, but the consensus seems to be that these are

rarely effective The drug BAL (British anti Lewisite) seems to provide a method of combating the toxic reactions of gold therapy and is being used for this purpose by many physicians

PHYSICAL THERAPY

If at all possible, physical therapy treatments, such as heat, massage, and exercise, should be given by a qualified physical therapist Since a great proportion of this treatment must usually be given in the home, it is important that the necessary procedures be simplified as much as possible, with a view to the type of equipment available in the home Treatment for the arthritic patient is time consuming, and, if possible, more than one member of the family should be instructed in the procedures for giving heat, gentle massage, and, if necessary, exercise These treatments have been learned and skillfully administered by teen age boys and girls to their parents when this has been necessary

All too often nurses must assume the responsibility of giving and teaching these treatments because there is no physical therapist available When this is necessary, instructions should be clearly given by the physician, so that the nurse understands exactly what treatments are to be done and what reactions to expect from them

Heat is often administered in the home by means of an *electric pad*, but unfortunately these pads tend to become too hot for the comfort or safety of the arthritic patient Even a medium temperature on electric pads is frequently as high as 181° F, while the high heat may reach 244° F Needless to say, these temperatures are far too high to be safe from risk of skin injury Bakers are more desirable for dry heat treatment, and these may be made at home of sheet tin, curved in a rooflike fashion, and fitted with sockets for 60 to 120 watt bulbs

Moist heat in the form of hot packs, or, where possible, submersion in warm water baths of 100° F seems to have a more desirable effect than dry heat Range of joint motion is markedly increased during the treatment in hot pools Hot paraffin affords an excellent way to apply heat to the arthritic joint Paraffin bricks can be purchased at the grocery at a small cost These are melted, and cooled until a thin film is seen to be forming on the surface If an extremity is to be treated, the hand or foot may be submerged in the liquid ten or twelve times in quick succession If the heat treatment is to be applied to the knee or back, the paraffin may be painted on with a brush in the same fashion This

coating of warm paraffin is allowed to remain in place as long as forty five minutes to one hour, and it will maintain the heat on the part for a considerably longer period A hairy surface should be oiled or shaved before the paraffin is applied Some doctors prefer that layers of gauze be interspersed between the layers of paraffin, and they frequently ask that the entire coat be left on for several hours or longer, since it supplies support as well as heat

Contrast baths provide another method of increasing peripheral circulation They should not be given without written instructions as to the temperatures of the baths as well as to the time of immersion in each Hot water will commonly be ordered from 105° to 110° F, cold water, from 60° to 65° F The hot immersion is used first and last Frequently the extremity is immersed for five to six minutes in the hot water, and for two to four in the cold

Massage is considered inadvisable when acute pain or local temperature is present, and harm may result from the wrong type of massage used at any time on these patients For these reasons, instructions given to the nurse to carry out this type of treatment should be very specifically prescribed Stroking or effleurage is generally ordered, and it should be light in touch and directed toward proximal points of the extremity The joint itself is usually not massaged

The physiologic action of massage tends to increase muscle tone and eliminate stiffness It has a definite action on the superficial layers of skin, and benefit is frequently derived from the improved circulation Treatments of this nature—heat and careful massage—are considered to give more temporary relief to the arthritic patient than any other known agent Nurses should be careful always to keep the extremities warm after such treatments, for chilling after the application of heat is likely to undo all the benefits obtained from its use

There is considerable diversity of opinion about the amount of exercise that should be given the arthritic patient It is felt by some that all joints should be put through a full range of motion just as soon as this is possible without causing the patient too much pain, and that this should be done daily to eliminate oncoming ankylosis Others object to this amount of motion, maintaining that if any inflammation at all exists in the joint, motion will only increase it, thereby causing pain and muscle spasm and considerable loss of courage on the part of the patient For this reason, it is better for the nurse to have specific instruction before

rarely effective The drug BAL (British anti Lewisite) seems to provide a method of combating the toxic reactions of gold therapy and is being used for this purpose by many physicians

PHYSICAL THERAPY

If at all possible, physical therapy treatments, such as heat, massage and exercise, should be given by a qualified physical therapist Since a great proportion of this treatment must usually be given in the home, it is important that the necessary procedures be simplified as much as possible, with a view to the type of equipment available in the home Treatment for the arthritic patient is time consuming, and, if possible, more than one member of the family should be instructed in the procedures for giving heat, gentle massage, and, if necessary, exercise These treatments have been learned and skillfully administered by teen age boys and girls to their parents when this has been necessary

All too often nurses must assume the responsibility of giving and teaching these treatments because there is no physical therapist available When this is necessary, instructions should be clearly given by the physician so that the nurse understands exactly what treatments are to be done and what reactions to expect from them

Heat is often administered in the home by means of an *electric pad*, but unfortunately these pads tend to become too hot for the comfort or safety of the arthritic patient Even a medium temperature on electric pads is frequently as high as 181° F, while the high heat may reach 244° F Needless to say these temperatures are far too high to be safe from risk of skin injury Bakers are more desirable for dry heat treatment, and these may be made at home of sheet tin, curved in a rooflike fashion and fitted with sockets for 60 to 120 watt bulbs

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not provided, subluxation of the joints may occur The thigh and calf are usually suspended by the use of canvas hammocks attached to a system of overhead pulleys As the contractures at the hip and knee level release, the hammocks are sometimes replaced by pillows until the patient is able to lie in a position of extension Whitman and Bradford frames are sometimes used to overcome the dorsum rotundum caused by arthritis of the cervical and thoracic vertebrae Since the arthritic patient in traction is usually thin and emaciated, it is particularly important that constant attention be given to the sacral area where much of the body weight rests as he lies on his back Physicians will usually allow these patients to spend a little time in the side lying position in order that the skin may receive proper care

OCCUPATIONAL THERAPY

In no type of crippling disease is occupational therapy more important than it is in arthritis The mental stimulation of actually making something serves as a psychological tonic of great importance in the treatment of this disease It is quite a well known fact that arthritic patients are as commonly cared for in the general hospital as they are in the orthopedic hospital, since they have in many respects as much a medical as an orthopedic condition All too frequently, trained occupational therapy service is not available to them Nurses must understand the importance of this service to the arthritic patient and use their own ingenuity in providing such work for their patients If physical therapy treatment is done, the handcrafts which the patient attempts should help to supplement this Usually crafts which serve to promote normal functional use of the joints are preferred, and effort should be made in particular to provide some activity which requires abduction and outward rotation of the shoulders as well as extension of elbows and wrists We are told that for these patients a project that takes intermittent motion is more desirable than one which demands a fixed position of the joint for an extended period, also, that the patient must be urged to take rest periods during his occupation, in order that muscular strength will not be overtaxed Exacerbations of joint pain should be watched for, and lessened activity should follow such flare ups

PSYCHOTHERAPY

Psychotherapy is a factor which looms so large in the treatment of these patients that it deserves further consideration The pattern of the

carrying out exercise of any type for her arthritic patient In general it is well to remember that all movements to the arthritic joint should be smooth, slow, and rhythmical Jerky pump handle movements should be avoided

It must be realized that when activity is started too soon or is too vigorous, it may be followed by an increase of pain Arthritic patients are frequently worse after beginning activities Some of them will use this as an excuse to avoid further effort, but the wise nurse, anticipating this reaction, will have her answers and encouragement ready It may very possibly be necessary to eliminate some exercises, however, in case the reaction is too severe

USE OF TRACTION IN ARTHRITIS

Traction may need to be used where painful arthritic deformities are present It is important to remember that where flexion of hips and knees is present, skin traction cannot be applied in the long axis of the leg without furnishing support for the calf and thigh If this support is

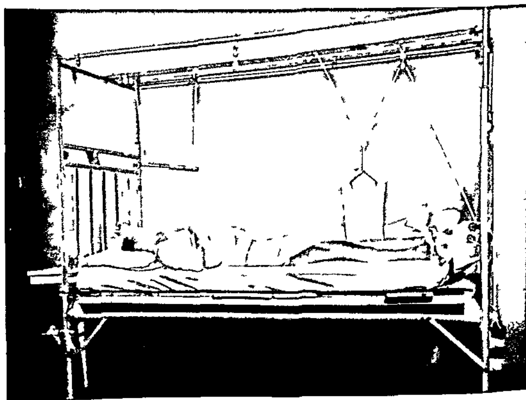


Fig 182 —Balanced traction used in arthritis to reduce contractures of hip and knee (Courtesy Arthur Steindler)

The change of position for back care and for removal of bed linen may disturb these patients considerably If the patient with considerable involvement has a system of moving about by himself, and prefers to do it that way, he should be allowed to do so It will take more time, and it is likely to be a tedious procedure, for such patients move very slowly, inch by inch, and it is impossible to hurry them without causing pain and lessening their confidence in the nurse's ability An overhead frame or a trapeze will be of assistance in changing the under linen, if the patient's arms are strong enough to permit him to lift himself slightly If this is impossible, it is a good plan to change draw sheets daily, but the under sheet less often Another plan which works very well is to use two under sheets, one of which tucks in at the head and reaches slightly below the buttocks, the other, placed beneath this, reaches from below the buttock level to the feet The upper section may usually be changed daily, the lower section only as necessary Inasmuch as moving of the lower limbs is usually attended with great pain, this arrangement of bed linen will avoid unnecessary movement where it is most painful

Nursing care should never be so superficial that points of pressure are not inspected daily Arthritic patients tend to develop pressure necrosis very easily, and such points as the sacral area, the heels, and the scapulae are very likely to become involved All reddened areas must receive prompt attention Massage with cocoa butter is good, and alcohol may be used to follow this Change of position can usually be managed, and, of course, this will do more than anything else to relieve vulnerable areas of the threat of decubiti

Rubber rings for use under the sacral region should be padded with outing flannel or canvas to eliminate as much as possible the heat producing effect of the rubber Such rings should be removed frequently and the lower back refreshed bv an alcohol rub

Upper covers must be so arranged that a heavy covering of bedclothes does not lie on any tender point A board at the foot of the bed is a good substitute for keeping covers off the feet where no cradle is available Soft woolen cloths, made of old blankets, can be placed over the limbs for warmth if necessarv A woolen shirt may add comfort to the patient in cold weather

The care of these patients demands a skilled pair of hands, and an intelligence that can strike and hold a balance between compassion and determination This is a kind of psychologic skill that any nurse may be

arthritic patient's life has been so altered by this particularly harassing disease, the adjustments he has had to make have been so profound, that it seems impossible that any nurse could fail for one moment to extend toward him the most wholehearted understanding Yet the care of this type of patient is *often the most trying experience with which nurses* come in contact during their professional career Sympathy is lost in exasperation if the nurse allows herself to become at all subjective about the patient s complaints of treatment

If the patient has been ill many months before he is brought to the hospital, some type of personality change may have occurred Loss of courage, pessimism brought about by his gradual recognition of the pro tracted nature of his disease, and extreme fearfulness of being hurt, all contribute toward changes in the personality of such patients They sometimes tend to be suspicious, often antagonistic, to a new nurse They have been ill a long time, and have been subjected to the ministrations of so many pairs of hands, some of them perhaps not too gentle, that any new adventure along these lines assumes the aspects of a liability Such an illness as arthritis, in the adult, is almost never uncomplicated by social and family problems of a grave nature, and sometimes this feature of the disease may play as important a part in the patient s ulti mate recovery as any other feature Emotional upsets, worry, chronic anxiety, and economic insecurity are so commonly seen in the back *ground of these patients that it seems as though they cannot* be dis regarded as having a definite connection with the onset of the disease

DAILY NURSING CARE IN ARTHRITIS

It is just as well for the nurse to expect that these patients will tell her exactly what to do and how to do it during the first few days she cares for them And there seems to be no very good reason why a nurse should resent these infringements upon her bedside activities, even though it may seem to her that she could do things in a much easier way if the patient would permit This is not to say that she must sacrifice her professional conscience by giving less than adequate nursing care to such patients—arthritic patients often come to the hospital from homes where every thing has been sacrificed to their comfort, where they have not even been asked to use a bedpan, or have the undersheet changed in spite of soiling Every nurse knows the certain necessary features that cannot be dis pensed with But during the first few days of care of these patients it is not unwise to gain their confidence by observing their requests It may smooth the way for later progress in the care of the patient

bring shoulders and arms into positions of abduction and outward rotation should be encouraged. Persistent encouragement will be necessary, but an appreciation of what all these minor activities may mean toward a functional return in joint and muscle power should always be remembered. Frequently the arthritic patient will beg the nurse to postpone all treatments and activities. He is sure he will feel more like having them the next day. While in some instances there may be justification for this, it is hardly a safe practice to establish. It will lead to future arguments that are better avoided by adherence to established routine in the carrying out of the nursing requirements.

THE AMBULATORY PATIENT

For the ambulatory arthritic patient, a well-fitting shoe is indispensable. Bedroom slippers and "comfortable old shoes," no matter how beloved of the patient, are to be avoided. Once he is supplied with the right type of shoe, the arthritic patient will soon come to see the difference these make in his ability to walk properly with comfort. Shoe corrections are frequently ordered, and these may consist of a soft felt arch pad, which is placed under the instep for longitudinal arch support, and the so-called Jones bar (or anterior heel) for the transverse arch. Walkers are often employed to start the severely affected arthritic patient in relearning the mechanics of walking, to be followed in a short time by crutches. The nurse should seek to establish early in the patient's mind the necessity for a normal gait while using these crutches, so that, when they are discarded, he may not have to unlearn faulty habits acquired during this period. The four-point gait described in a previous chapter will suffice for the arthritic patient.

Instructions for home care of the arthritic patient should include diet requirements, amount and type of rest, the necessity for sun therapy, as well as specific advice about the prevention of deformity. If the patient is still at bed rest, warning must be given about the unwise use of pillows under head, shoulders, and knees. Desirable bed posture can be defined, and the necessity for maintaining it over a large portion of the day and night should be emphasized. If the patient is discharged wearing braces or night splints of some variety, the necessity for wearing these consistently must be stressed. The significance of urging the patient to become independent through self-help must not be omitted from these instructions, and the parents or family should be made to understand that they do the patient no kindness in attempting to perform many simple activities for him.

proud to possess, for in these situations she must secure the patient's confidence despite the fact that she will probably be called upon to hurt him severely in her effort to overcome the results of long neglect in the home. All this will demand moral stamina and courage and a maturity of emotional development, and it requires ability to overlook antagonism and resistance to treatment on the part of the patient and firmly to resist all impulses in herself to obtain her ends by argument or nagging.

A systematic routine in caring for this type of patient is advisable. As nearly as possible, the same time should be allotted each day for the arthritic patient's bath and treatments, and, as much as is possible, the nurse should avoid subjecting him to hurry on busy days. The arthritic patient easily recognizes a hurried nurse, for her hands mean more pain to him. The daily bath is usually considered almost a necessity, because in this disease there is considerable disturbance of circulation, perspiration is often profuse and has a definite rather sour odor. Baths should be very warm and the water should be changed frequently enough to avoid chilling the patient as it cools. The room should be warm and free of drafts. A soft wool blanket is preferable to a cotton one for the arthritic patient's bath.

Mouth care is an important nursing detail where ankylosis of the jaw prevents proper cleaning of the teeth and tongue. This can be carried out after meals with the aid of a small syringe and tongue depressors wrapped with bandage. Glycerin and lemon juice are good cleansers. For such patients special ground food is often necessary. Frequently anesthetics are given and the jaws are spread apart forcibly to break up adhesions and to give the patient better ability to masticate solid food.

In some sections of the country, colonic irrigations are frequently prescribed, for intestinal stasis is thought by many physicians to play a considerable part in the etiology of arthritis. Such irrigations are usually given with normal saline about 112° F., and large amounts are needed if the irrigation is to have its maximum effect. Preferably the patient is in the knee chest position for this treatment, but because of pain and ankylosis this will very often be impossible and the irrigation may be given in the side lying position as for an enema.

Whatever the patient can do for himself without too great an expenditure of energy he should by all means be encouraged to do. He may, if possible, feed himself at least part of his meal. He should be encouraged to comb his hair, to wash his face as all these things promote mobility in fingers tending to become stiff. Any task that will tend to

manner of rheumatoid arthritis When the patient understands this, a great burden is sometimes lifted from his mind, particularly if he is in secret fear of becoming a helpless cripple, having perhaps seen a friend or relative crippled up with rheumatism"

Local treatment may consist of heat in some form, baking, diathermy, hot moist fomentations These latter may be given as in poliomyelitis and have often been found to afford considerable relief from pain and muscle spasm Massage may be ordered to the muscles above or below the affected joints Exercises must be taken cautiously, as they tend to be followed by exacerbation of symptoms Complete immobilization, on the other hand, must also be avoided because of the danger of disuse atrophy There are no specific drugs or vaccines for hypertrophic arthritis, although salicylates are commonly ordered for relief of pain

NURSING CARE IN HYPERTROPHIC ARTHRITIS (OSTEOARTHRITIS)

A large proportion of patients with hypertrophic arthritis are cared for in the home Mild degrees of the condition are very common among the population beyond middle age These individuals will usually be hospitalized only when reconstructive surgery is necessary, although they may enter the hospital briefly for corset or brace fittings or for periods of physical therapy

The health supervision the nurse can give in the home may be an important detail These are the patients who so frequently patronize chiropractors, and come to the attention of a physician only after a series of unprofitable 'adjustments Nurses should use their influence to bring them under the care of a qualified medical man whenever possible

Health supervision will include attention to details for improvement of the patient s posture and general habits of working, sitting, and standing Constant sitting for patients with hypertrophic arthritis of hip or spine is a bad practice as it often leads to flexion contracture of hips, adduction of hips, and a tendency to dorsal kyphosis Within the limits of the patient s tolerance, activity is to be encouraged These are not patients who are to be encouraged to assume a life of idleness or sedentary occupation where other activity is possible If shoe corrections have been prescribed, nurses should check frequently to see that these do not become worn down and useless Shoe corrections provide support and comfort to pronated feet, which are common in this condition, and they may have a great deal to do with improvement in posture If a brace or corset has been ordered, frequent inspection of the apparatus and supervision of its application is important If postural exercises have been prescribed, the nurse should have a full understanding of these, so that she may be able to assist and encourage the patient in their performance Since overweight and intestinal stasis are common in this condition, the diet should be one which will assist in eliminating both these factors Diets should include large quantities of green vegetables, and starches and sugars should be used sparingly Weight reduction should, of course, always be under the supervision of the doctor

Another point of importance in which the nurse may play an important role is that of giving reassurance Worry is not an uncommon feature encountered in patients having this condition They should be brought to understand that hypertrophic arthritis does not tend to cause rigid joints and that it does not go from one joint to the other in the

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QUESTIONS FOR STUDY—UNIT VII

1 Discuss the general treatment of rheumatoid atrophic arthritis from the standpoint of diet, medication rest habits and psychotherapy

2 Differentiate between atrophic and hypertrophic arthritis

3 What are the early symptoms of atrophic arthritis?

4 What types of deformity are common in atrophic arthritis? How does poor bed posture contribute to these deformities?

5 Describe methods used to prevent the common deformities found in atrophic arthritis

6 What types of physical therapy have been found beneficial to the patient with atrophic arthritis?

7 Construct a nursing care plan for a patient with atrophic arthritis with mild involvement of legs arms and back

8 Discuss causes and treatment of hypertrophic arthritis

Unit VIII
POLIOMYELITIS

Chapter 18
POLIOMYELITIS

CAUSE

There are a few cases of poliomyelitis in every community every year, but occasionally the disease appears in epidemic form It is most common in the late summer and fall months, although epidemics have occurred in the early winter months Young children are most often affected, but there seems to be no age limit to the susceptibility to infection

One theory is based on the probability that it is a common childhood disease, but that paralysis occurs only in the severe cases and that immunity against the disease is developed in many instances without the entire clinical picture being present and without knowledge that the individual has had the disease This is borne out to some extent by clinical studies in large epidemics in which it appears that only about 10 per cent of those who are examined show some laboratory and some clinical evidence of the types which develop paralysis

In a recent epidemic, the majority of cases seemed to follow one of the main highways from the south to the north, but the significance of this has not yet been interpreted The presence of an insect carrier is suspected

More recently there has been extensive investigation along the line of the intestinal tract and sewage transmission and transmission by carriers Carriers may themselves be immune to the disease but, harboring the disease either in the nasal passages, the lingual glands, or the intestinal tract, may transmit it to those with whom they come in contact

The infectious organism is known definitely to be a virus which is minute enough to pass through the Berkefeld filter, but it has never been demonstrated microscopically Unfortunately, animal experimentation is greatly limited because monkeys are practically the only animals susceptible to the disease

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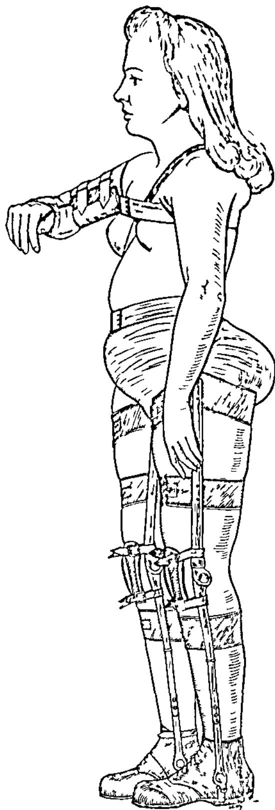


Fig 183 — Patient with poliomyelitis having braces to support residual paralysis in legs and right arm This girl after eight months of surgical treatment wore no braces walked without support and was in college After three years she was a successful technician in a large clinic group

SYMPTOMS AND SIGNS

The disease usually starts rather abruptly with a headache and an intestinal disturbance There may be an elevation of temperature to from 99° to 102° F There is usually some evidence of spinal cord irritation which is recognized by stiffness of the neck with some resistance and pain in the back when attempts are made to raise the head from the bed Paralysis, when it develops, usually occurs somewhere between the third and seventh day after the onset of the illness However, in some cases the initial symptoms are so mild that the disease is not recognized until paralysis has set in The child may fall because of weakness of a limb

In those cases in which paralysis does not develop, all symptoms may disappear within two or three days Where paralysis develops, there may be pain on movement of the limbs and joints or on pressure upon the muscles involved After the acute symptoms, the child is usually quite comfortable except for this

PATHOLOGY

The destructive lesions in poliomyelitis are in the anterior horn cells of the spinal cord The motor system of our body consists of three groups of cells (1) those in the brain which initiate the motions, (2) those in the medulla and ganglia, which coordinate the motions, and (3) those in the spinal cord (the anterior horn cells) which transmit the impulse to the muscle cells

The anterior horn cells are distributed in groups throughout the entire spinal cord but are concentrated to a great extent in the groups which supply nerve impulses to the upper and lower extremities These groups of cells are arranged more or less in small groups supplying individual muscles, such as the deltoid, the biceps the gluteus maximus, the quadriceps, etc.

During the attacks the following may occur (1) There may be several areas where complete destruction of cell either by local activity of the disease itself or the destructive effect of the toxins formed may cause an actual degenerative process of varying size and degree (2) Waste products and edema may endanger the vitality of a major group of cells around the destroyed area (3) Beyond this are large inflammatory changes which temporarily incapacitate a much larger group of cells This accounts for the degree and speed of recovery of the functional power in muscles

recovery of the nerves but rather to improved function of the muscle fibers whose nerves of stimulation have already recovered

There are two other types of involvement with poliomyelitis (1) The *bulbar type*, which consists of an involvement of the nerve cells high up in the spinal cord If the inflammatory condition reaches the vital centers, the condition is fatal If the damage is not sufficient to cause death, a relatively complete recovery usually occurs within a few weeks or months These cases may require the use of the respirator during the more active stage because of the paralysis of the intercostal muscles and diaphragm (2) *Poliomeningitis*, where the symptoms are frequently very similar to other forms of meningitis with delirium, stiff neck, strabismus and incontinence Actual paralysis of the muscles is not usually present There may be flaccidity of the extremities or spasticity

TREATMENT

Treatment is divided into three stages acute, convalescent, and reconstruction

1 Acute Stage —During the acute and febrile stage, rest is all important A firm bed and relaxation of the affected extremities in a position of physiological rest has been the treatment of choice This consists in maintaining the shoulder at right angles to the body, the elbow at right angle flexion, and the wrist at slight dorsiflexion In the lower extremities, the knee and hip are flexed a few degrees and the foot is held in a position at right angles to the leg There has developed a great deal of enthusiasm for the Kenny treatment, which consists chiefly in the application of specially shaped pads of hot moist compresses to the limbs for twelve hours daily Motions of the joints are carried out on definite schedules, and substitutionary motions are not allowed (see Nursing Care) This treatment seems to have the advantage of eliminating stasis in the muscles, thereby preventing spasm and contractures, maintaining flexibility, and making the patient more comfortable, but, unquestionably, *nothing can effect the recovery of the nerve cells in the anterior horn of the spinal cord* If this type of treatment can prevent the tendency to spasm and contracture in the unparalyzed muscles and make the patient more comfortable, it is totally worth while in the acute and early convalescent stages Modifications of this method seem to prove more valuable Much has been "ironed out' as to the advantages and disadvantages of intensive treatment in the various stages of acute poliomyelitis since this 'ritualistic form of treatment has been publicized Complete immobilization is no longer advocated for any prolonged period

In the completely destroyed areas (1) there will never be any return of muscle power* In the intermediate zone (2) the cells may recover or disintegrate according to the demands placed upon them Rest is the important factor The cells damaged by relatively mild inflammatory change only will recover under almost any condition

The rapid recovery which takes place within one to three weeks following an attack of poliomyelitis is due to the fact that the muscles are innervated by group three

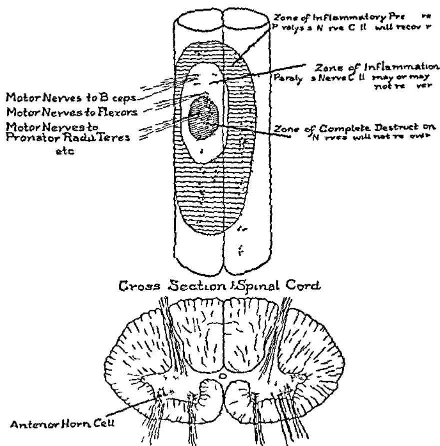


Fig 184—Schematic drawing of spinal cord showing method of attack of poliomyelitis

The recovery which may or may not take place in the following weeks or months is directly related to the number involved in group two

The permanent paralysis is directly related to the number of cells involved in group one

Improvement continues in infantile paralysis cases for at least several years, but any improvement after a few months is not due to any further

recovery of the nerves but rather to improved function of the muscle fibers whose nerves of stimulation have already recovered

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TREATMENT

Treatment is divided into three stages acute, convalescent, and reconstruction

1 Acute Stage —During the acute and febrile stage, rest is all important A firm bed and relaxation of the affected extremities in a position of physiological rest has been the treatment of choice This consists in maintaining the shoulder at right angles to the body, the elbow at right-angle flexion, and the wrist at slight dorsiflexion In the lower extremities, the knee and hip are flexed a few degrees and the foot is held in a position at right angles to the leg There has developed a great deal of enthusiasm for the Kenny treatment, which consists chiefly in the application of specially shaped pads of hot moist compresses to the limbs for twelve hours daily Motions of the joints are carried out on definite schedules, and substitutionary motions are not allowed (see Nursing Care) This treatment seems to have the advantage of eliminating stasis in the muscles, thereby preventing spasm and contractures, maintaining flexibility, and making the patient more comfortable, but, unquestionably, *nothing can effect the recovery of the nerve cells in the anterior horn of the spinal cord* If this type of treatment can prevent the tendency to spasm and contracture in the unparalyzed muscles and make the patient more comfortable, it is totally worth while in the acute and early convalescent stages Modifications of this method seem to prove more valuable Much has been "ironed out" as to the advantages and disadvantages of intensive treatment in the various stages of acute poliomyelitis since this "ritualistic' form of treatment has been publicized Complete immobilization is no longer advocated for any prolonged period

2 Convalescent Stage Prevention of Deformity—Deformity should be prevented during the convalescent stages, but if it occurs, or if weaknesses persist, the limbs must be protected by braces or the deformities corrected by operation, or both

3 Reconstruction Stage—The entire plan of reconstructive surgery in infantile paralysis is based on the fact that joints are controlled by groups of coordinating but opposing muscles For example, in the ankle plantar flexion results from action of the gastrocnemius (calf muscle group) and flexors of the toes This is opposed and balanced by the extensor group of muscles—the tibialis anticus, the peroneus brevis, and the extensors of the toes Inversion of the ankle is accomplished by action of the tibialis anticus and the tibialis posticus assisted by the flexors of the toes

If the extensors of the toes are paralyzed, the foot will turn inward and there will be a drop foot deformity Likewise, weaknesses of various types will develop with paralysis of other groups of muscles

Reconstruction surgey is based on the elimination of the joints (by operative fixation), which allow the deformity to occur, or by the transplantation of certain selected tendons to replace the action of paralyzed ones, or by a combination of joint fixation and tendon transplantation

There are a number of mechanical tricks learned through experience in operative surgery which may in some instances save part or all of the motion in certain joints and still eliminate the ability of the stronger group of muscles to create deformity

Many operations are designed to correct various deformities and contractures *which have developed before the case is first observed* These consist frequently in detaching the contracted muscle from its origin and allowing it to reattach to bone in a position which will accomplish straightening of the joint or limb

SOME SPECIAL OPERATIONS

When there is a permanent paralysis of the deltoid muscle with a frail and useless shoulder, the shoulder may be stiffened in a position of abduction (60 degrees for children and 65 degrees for adults), provided there is good power in the muscles about the shoulder blade and reasonably good power in the hand Following the operation, the entire upper extremity and the body are placed in a cast until bony union within the joint is present Joint fusions are usually accomplished by the complete removal of all cartilage from the component surfaces Frequently a

bone graft is used in addition, so as to transfix the joint, stabilize it, and speed the fusion time Complete fusion usually takes place in from three to six months

One of the commonest deformities in the hand consists in the paralysis of the opposing muscles of the thumb This causes the loss of grasping and holding power The condition may be improved or corrected by tendon transplantation One method consists in transplanting one half of the long extensor tendon of the thumb to the posterior surface of the proximal phalanx of the thumb near its articulation with the metacarpal (Steindler) The method of Bunnell utilizes the flexor carpi ulnaris or the palmaris longus tendons, attaching them by a transplantation to the flexor of the thumb through a loop around the carpal bones of the outer side of the hand

SPINE

Many of the worst cases of curvature of the spine are the result of paralysis of either the spinal or abdominal muscles These curvatures should be prevented as much as possible during convalescence, but when they occur they must be corrected

The first step in the correction of paralytic curvature of the spine is through the use of corrective casts, such as the Risser cast When the spine has been straightened, it is fused by operation on the involved area By means of this it becomes rigid where the curve is most severe The operation is frequently performed through a window which is cut out of the back of the cast The cast usually includes the head, extending over the body and down one leg It is kept on for four to six months It is then replaced by another cast extending from the armpits to and including the pelvis, and the patient is then allowed to be up and about

In cases where curvature is due to abdominal weakness, transplants of the strong ligamentous material from the outer side of the thigh (fascia lata) are made, replacing the paralyzed muscles (Lowman and Leo Mayer) These bands usually are stitched to the brim of the pelvis and to the ribs so as to form inelastic stabilizing sinews beneath the skin, preventing rotation of the body and curvature There are a number of applications of this method of stabilization

Where there is a flexion contracture of the hip, the muscle attachments, including a shell of bone, can be freed from the anterior and lateral portions of the crest of the ilium (Speed), thereby releasing the contracted muscles and giving correction of the deformity A plaster hip spica is used to maintain correction for six to ten weeks

There are a number of operations designed to stabilize the knee, but if both the knee and ankle are severely paralyzed, a long leg brace extending from the ischium to the shoe frequently constitutes the best form of treatment. However, if stabilization of the knee is desired, it may be done as follows: by (1) a bone block operation to limit flexion of the knee joint, (2) a bone block operation to prevent hyperextension of the knee joint (back knee), and (3) complete ankylosis or fusion of the joint in a position of the greatest usefulness as far as the occupation of the particular individual is concerned.

Before a fusion is done by operation, it is well to test the probability of success and satisfaction to the patient by applying a plaster of Paris cast over the thigh and leg and allowing him to get about for a few weeks with the leg in a fixed position.

Knock knee and outward rotation of the tibia and foot are common deformities in infantile paralysis. They can be corrected by an osteotomy of the bone just below the knee with inward rotation of the tibia. Immobilization in plaster for eight to ten weeks is required for healing.

ANKLE

At the ankle, operations are designed to correct the most common deformities. Drop foot, with inversion of the ankle and foot (equinovarus), is best treated by a modified Hoke operation which consists in the removal of a wedge shaped portion of bone from the undersurface of the astragalus. The base of the wedge is forward and outward so that both deformities are corrected at the same time. The bone surface is freshened on both sides and all cartilage is removed so that prompt ankylosis takes place. A plaster of Paris cast from the toes to the groin maintains the corrected position during healing. The portion of the cast above the knee may be removed about two months after operation but complete ankylosis rarely occurs in less than four to six months.

Where the drop foot is uncomplicated, a bone graft to limit ankle motion to a right angle position may be done. When the arch is abnormally high due to contracture of the plantar muscles, the detachment of these muscles from the os calcis (Steindler) followed by manipulation and stretching will give correction in the milder cases. In the more severe cases, the removal of a wedge shaped piece of bone from the tarsal region (dorsal surface) may have to supplement this procedure.

There are comparatively few tendon transplantations which are permanently successful in the lower extremities, but there is one which gives

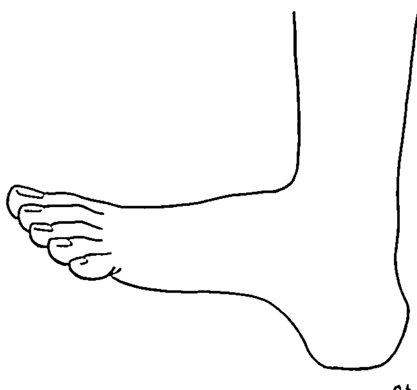
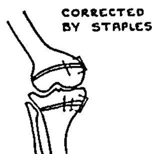


Fig 185 —Paralytic calcaneovalgus deformity

KNOCK-KNEE LEG SHORTENING



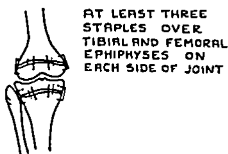


Fig 186 —Drawings showing epiphyseal arrest used in knock knee and for leg shortening

quite satisfactory results In cases of clawfoot (retraction of the toes), successful results are obtained by the transplantation of the extensors of the toes into the metatarsal bones near the heads It is usually necessary to fasten these tendons through drill holes in the metatarsals so that their anchorage will be secure

EPIPHYSEAL ARREST

Unequal growth of legs may be an aftermath of poliomyelitis contracted in early childhood To correct this condition by equalizing the length of the legs is an important consideration in orthopedic surgery

Phemister and others showed a number of years ago that arrest of epiphyseal growth could be effected by forms of localized epiphyseal destruction or disturbance Their plan was based on the fact that equalization of leg length could be obtained by such disturbance and retardation of growth at the epiphyseal line and could be accomplished by a block osteotomy over the line with a 90 degree rotation of the fragment (a square plug) Since this is rotated, it causes a fusion or elimination of the growth line resulting in the stoppage of growth of the limb The state of the epiphysis as shown by x ray and a family history of height statistics give a clue as to the time that epiphyseal growth should be stopped

Recently, Walter Blount has shown clinically that the principle of epiphyseal arrest can be applied to many more problems By the use of stainless steel staples it can be applied not only to the equalization of leg length but also to the calculated control of knock knees and bowlegs Moreover, this process may be stopped and controlled by the timely removal of the staples" Blount has found that one staple on each side may break as a result of epiphyseal growth strain and about three staples are necessary to stop the growth Strangely enough, however, if the staples are removed before complete closure of the epiphyses, growth is restored These findings open up a new field of leg equalization as well as the correction of bowleg and knock-knee deformities at a calculated time before puberty or the closure of the epiphyseal lines

In addition, deformities such as a flexed knee or a hyperextended knee can be corrected by staple fixation The staples can be discontinued at the proper time (See Fig 186)

Chapter 19

NURSING CARE OF PATIENTS WITH POLIOMYELITIS

PREPARATION FOR MEETING AN EPIDEMIC

Community preparation to meet a possible epidemic of poliomyelitis should be begun many months before the epidemic season arrives, for the mobilization of community resources cannot be accomplished overnight Unified action in the event of an epidemic will only be possible if a committee has been organized beforehand to make preparations to meet the emergency There should be representation from the local hospitals, the medical and nursing groups, the social agencies, the local chapters of such organizations as the National Foundation for Infantile Paralysis, the Society for Crippled Children and Adults, State Crippled Children's Services, and other civic groups which are organized to assist the ill or handicapped The function of such a committee will be to attempt to determine the number of local hospital beds which can be used in the epidemic season for the care of polio patients in the isolation and convalescent stages This committee will also make an estimate of the number of professional personnel with training in the care of poliomyelitis who will be available, and will seek to discover sources of equipment needed for treatment, such as hot pack machines, woolen material, respirators, splints, and other materials Effort will also be made to discover if enough laboratory, diagnostic, and consultation services exist in the community to provide adequate care for large numbers of patients during an epidemic

Plans for *continuity of care* are almost as important as plans to meet the emergency of an epidemic People are pitched to a high degree of community spirit during an emergency and will do almost anything they can to help, but it takes considerable foresight to plan to maintain this spirit of cooperation after the emergency is over This feature should not be overlooked in community planning to meet an epidemic

In epidemic periods it is often hard to remember that anyone's work is of importance but one's own Yet teamwork in a poliomyelitis epidemic is indispensable, and a constant awareness of the importance of the other groups working for the patient's welfare must not escape the nurse She should be completely informed and appreciative of the work

done by these people and should have a clear understanding of her own part in the total scheme of treatment. She will need to learn to work with physical and occupational therapists, with social workers, public health groups, parents, volunteers, and many others for complete success of the program.

Volunteers have made an important contribution to the care of poliomyelitis patients during recent epidemics. It should be clearly understood that the volunteer helper will be able to assist in an epidemic in direct ratio to the way she has been selected and instructed beforehand, as well as in the way she is assigned, supervised, and appreciated during the epidemic.

POLIOMYELITIS VACCINE

The method by which poliomyelitis is spread from person to person is not known. However, during the past few years there has been considerable progress in immunization against this disease. The vaccine produced by Salk, of *inactivated poliomyelitis virus (formaldehyde treated)* is capable of inducing the production of neutralizing antibodies. This vaccine is prepared from selected strains of each of three virus types.

During the spring and summer of 1954, the National Foundation for Infantile Paralysis sponsored a large scale field trial of the Salk vaccine. The reports of this program demonstrated that the vaccine had been safe and effective in substantially reducing the risk of paralytic poliomyelitis in the vaccinated groups.* Since this time the supply of the vaccine has become more plentiful and assistance has been provided by federal, state and local governments in making the vaccine available to the nation's population. Tentative reports continue to be favorable pertaining to the Salk vaccine, but it is apparent that further study and work in the control and prevention of poliomyelitis are necessary.*

CURRENT THEORIES REGARDING SPREAD OF THE DISEASE

Since it has been established that the virus may leave the body of the patient (or a healthy carrier) in the discharges of the bowel or the nose and throat, it seems safe to assume that person to person contact must play a large part in the spread of the disease. Although the upper respiratory passages are no longer considered the *primary* routes of in

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* Scheele, Leonard A.: *Control of* [illegible], The [illegible] Journal of the American Medical Association 158: 1271-1281, Aug. [illegible] 1955.

fection, nevertheless the exact manner in which the virus enters the body is not completely understood and care should be used in handling the discharges from the nose and throat of any patient suspected of having poliomyelitis The virus has repeatedly been recovered from the throat of patients during the first three to five days of the disease For this reason it would seem advisable for nurses caring for these patients during the acute stage to be masked while working directly over the patient in order to prevent contamination by droplet transmission, and to disinfect all discharges from the nose and throat as carefully as those from the gastrointestinal tract

Since it is now an accepted fact that the virus of poliomyelitis remains in the gastrointestinal tract sometimes over a period of weeks, considerable attention must be given to the matter of disinfecting stools The nurse working in the communicable disease hospital where these patients are cared for should seek definite instruction as to the disposal of excreta The process will vary somewhat from state to state, according to rules set down by the State Board of Health Where an efficient sewage disposal system is available, of course, fecal disinfection is not necessary Where possible it is advisable to use disposable diapers for young children during an epidemic

Present day knowledge seems to indicate that there are many strains of the poliomyelitis virus which cause the disease in human beings Immunity from infection from one strain of the virus does not necessarily assure immunity from others Furthermore, the virus has been noted to be extremely variable in its activity in different hosts and to alter considerably with the changes in and around these hosts The time factor, for instance, from exposure to the onset of the disease seems to be exceedingly variable, and it has been stated by some investigators that an outbreak lasting several weeks may possibly be due to exposure of all victims at the same time

It has been known for quite some time that fatigue and chilling seem to play a definite part in the etiology of the disease The explanation of this is not entirely clear, but it is thought by some authorities that the spinal cord may be invaded by the virus in the early stages of the disease—that it is, in fact, present in the cord about as early as it is in the intestinal tract Strenuous work or exercise or chilling may be the factors needed to activate the virus, or to lower the body s defenses against the disease, so that immediate paralytic symptoms appear Parents should be instructed to insist on proper rest habits for their children during epidemic seasons and to guard against overexertion and chilling

done by these people and should have a clear understanding of her own part in the total scheme of treatment. She will need to learn to work with physical and occupational therapists, with social workers, public health groups, parents, volunteers, and many others for complete success of the program.

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* Scheele, Leonard A.: Control of Poliomyelitis Through Vaccination, Journal of the American Medical Association 158:1211-81, August 1955.

every recognized case there are probably many others unrecognized in persons who, although they do not develop symptoms, are immunized against the disease because they have had it in a mild form. Furthermore in those recognized cases it has been found that from 50 to 75 per cent of the patients recover completely or have so minor a disability that it does not keep them from living out a normal life. Only about 15 to 20 per cent will be seriously and permanently crippled. In the ordinary epidemic, from 5 to 10 per cent will die.

HOW POLIOMYELITIS IS DIAGNOSED

The early symptoms of poliomyelitis are not such as will point definitely to the disease in a nonepidemic period. Headache is present in a large percentage of the patients who are old enough to complain of it. Fever is not excessively high, ranging usually from 101° to 103° F. Nausea and vomiting, constipation or diarrhea may be present. Stiff neck and back are common. Many physicians have commented that the early symptoms tend to be "flu like" in character (the "characteristic minor illness") but a head cold is not considered a common early symptom of poliomyelitis. Sore throats occur in a low percentage except in the bulbar type of the disease, where they are considered to be of neuritic origin. Considerable soreness of peripheral areas to the touch is commonly found, and spasm of the posterior neck muscles, the back extensors, and the hamstrings is thought to be highly significant in diagnosing the disease.

All these symptoms may disappear after twenty four hours. Sometimes there is an interval of a week or more before further symptoms appear. Formerly this type of onset was referred to as "dromedary" but is now called "bactrian," it having been belatedly recognized that the bactrian is the two humped camel!

Fully developed cases of poliomyelitis almost invariably show muscle tenderness and rigidity in the back, neck, and hamstrings. The tendency for the patient to assume what has sometimes been called the "frog" position has long been considered characteristic of the disease. Since sacrospinalis spasm and hamstring spasm are present in a large number of cases, whether they be severe or so mild that paralysis does not develop, it is easy to understand why flexion of the knees and hyperextension of the back and neck are often observed.

Diagnosis is usually confirmed by the spinal tap, but many physicians tell us that this also is not definitely conclusive. Diagnosis can be confirmed in nonepidemic seasons only by the unsymmetrical nature of the

HEALTH TEACHING DURING AN EPIDEMIC

The core of the nurse's teaching during epidemic seasons is based on a few rules of good hygiene dictated by our present day concepts of the disease Since in many cases it seems unquestionable that the virus is ingested, all foods should be protected from filth, flies, dirty hands, and animals If food is to be eaten raw, it should be well washed before eating Hands should be carefully washed not merely before meals, but before eating any food Milk should be certified or pasteurized, and the water supply should be from approved sources However since one of the nurse's chief duties during epidemics is to prevent the spread of misinformation, it should be pointed out at this time that modern epidemiological evidence does not seem to indicate that infected milk or water has ever been the source of an epidemic

The necessity for having adequate rest and of avoiding strenuous exercise and chilling should be emphasized in health teaching Congested areas should be avoided and the number of new contacts a child makes should be cut to a minimum The closing of schools is not usually recommended, because the child is thought to be less vulnerable to contamination among his habitual companions than he would be if allowed to mix with other groups outside the school Any child who complains of any of the symptoms which are common in poliomyelitis should be immediately segregated until he is seen by a physician

In addition to instruction regarding the purely physical aspects of prevention of the spread of poliomyelitis in a community—and there is, on the whole very little that one can say in this regard—it is necessary to help the parents to an intelligent understanding of the nature of the disease Much community panic and hasty, ill considered actions may be avoided if the public is well informed about modern concepts of the disease

Those who have worked in communities where a poliomyelitis epidemic was in progress know all too well the extent to which panic can carry the people False rumors seem to arise from nowhere and are carried with incredible speed It is true that fears cannot be totally allayed by knowledge, but it does provide a bulwark against mass hysteria The voice of reason is small but it is persistent

Although statistics may seem a cold way of giving comfort to parents living in terror for their children during an epidemic, they are, nevertheless, often a source of surprising reassurance We are told that poliomyelitis is not by any means always a crippler, and it is said that for

has are mild or disguised by another condition One adult patient told of the onset of the disease as being so mild and localized that he thought it was a return of a myositis of the shoulder which he sometimes had seasonally Another, a young woman in the seventh month of pregnancy, recognized nothing until she returned from a shopping trip and became paralyzed an hour later

ISOLATION OF THE PATIENT

The incubation period for this disease is now thought to be rather brief, but it appears that in some instances it may be as long as thirty five days The average period, however, is usually considered to be from about four days to two weeks As in other infectious diseases, a short incubation period has been noted to be significant of a more severe involvement The period of infection is at present thought to be about three days before and three days after the onset of prodromal symptoms

The patient is usually isolated about two weeks, although in some localities it may be longer The fact that recent investigations have established the presence of the virus in the gastrointestinal tract for many weeks after the onset of the disease makes the whole question of quarantine a very knotty problem at the present time The extent of isolation varies in different localities and in different institutions Rigid isolation precautions may be the rule in some instances, group isolation in others The nurse may work in some localities where segregation and scrupulous attention to cleanliness and the disinfection of excreta are the only precautions observed However, the general tendency is still toward careful isolation of these patients

Infantile paralysis is usually considered as customarily attacking only one member of a family This has never been consistently confirmed by experience While it is true that often only one member of the family becomes paralyzed, it is suspected that many of the family are affected and that they probably become infected through a common source In most of the victims, however, paralysis does not develop, and it is not recognized that the others have manifested their disease by mild symptoms such as those of a summer cold, "flu," or similar indispositions

THE NURSE'S RESPONSIBILITY IN DIFFERENT TYPES OF TREATMENT

Until a few years ago, treatment of the paralysis in poliomyelitis was based upon principles of constant protection of the weakened muscles

paralysis However, in epidemic seasons, a spinal fluid examination which reveals a slight increase in pressure, a clear appearance, a cell count of from 10 to 300, or slightly higher, is considered very significant The cell count, if done early enough, shows a predominance of polymorphonuclear leukocytes, but these are succeeded within twenty four to forty eight hours by lymphocytes Spinal sugar is normal, nurses will remember that it will be about one half the amount of the blood sugar, chlorides are normal, Pandy's test for spinal globulin may be positive, 1 to 4 plus The total protein is usually increased, and an elevation of 45 mg per cubic millimeter or above is thought to be significant The virus has not yet been found in the spinal fluid, nor has it been isolated in the blood stream

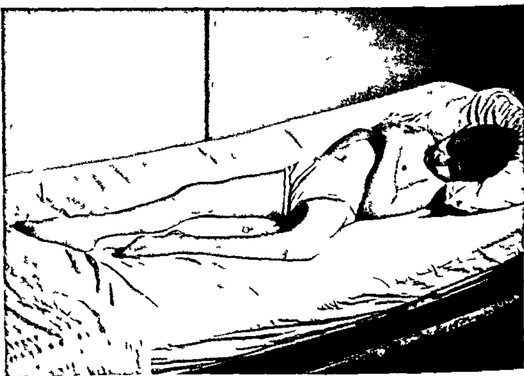


Fig 187 — Frog position often assumed by child with poliomyelitis during the acute illness (From Care of Infantile Paralysis in the Home A Handbook for Parents prepared by A Steindler and T J Greteman Courtesy the authors)

Some patients have none of the above systemic symptoms or have them in so minor a degree that they are overlooked as having any significance There is also the patient who apparently has no symptoms at all until he actually becomes paralyzed What prodromal symptoms he

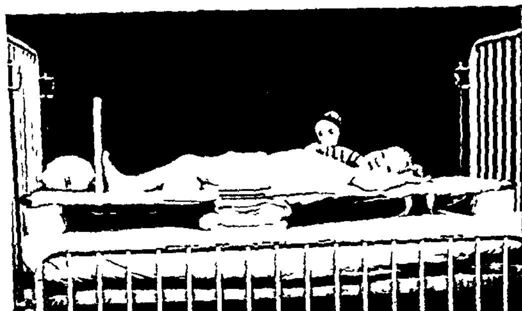


Fig 188 —Child with *poliomyelitis on* Bradford frame with divided *cover to* facilitate use of bedpan (From Care of Infantile Paralysis in the Home A Handbook for Parents prepared by A Steindler and T J *Greteman* Courtesy the authors)

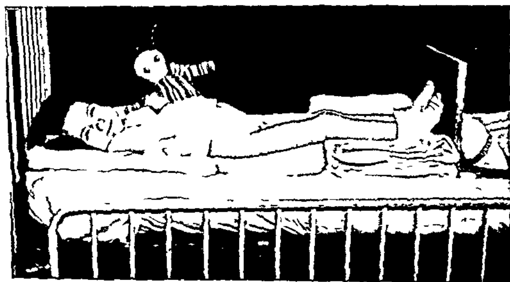


Fig 189 —Arrangement of bedpan for child *not on* frame so that support of back and legs is maintained (From Care of Infantile Paralysis in the Home A Handbook for Parents prepared by A Steindler and T J Greteman Courtesy the authors)

All nursing procedures had to be adapted to this feature of treatment Weakened muscles were protected against the strong, normal antagonist at all times lest they be stretched out like old elastic The weakened muscle was kept as short as possible to protect against stretching—that is, the origin and insertion of the affected muscles were brought as close together as was possible and kept that way during a long course of treatment and bed rest This was accomplished by the use of splints and later by braces Aside from this one common feature of immobilization for muscle protection, there was no universal agreement as to the care of the patients Mobilization varied in degree and type from complete rigid immobilization in circular casts, to the use of splints for only part of the day while complete range of joint motion was carried out during physical therapy treatments

Muscle tenderness, a fairly constant symptom, was of great concern to patient and nurse Because of this tenderness physical therapy was usually not begun till the end of this period, although there were exceptions to this rule and some doctors ordered daily warm baths or packs soon after quarantine was over, or, in some cases, before Heat and massage, passive and active exercises, were seldom begun while any muscle tenderness existed Muscle stimulation through electricity had some advocates but it was not in general use Improvised splinting by use of pillows sandbags towels, boxes, and the like were usually employed for muscle protection until the period of quarantine was over After that, permanent splints—such as bivalved casts, wire splints, or specially constructed metal and leather apparatus—were employed

External heat for the elimination of muscle tenderness was used in many localities for years Some institutions routinely applied hot moist packs for this Others used dry heat in some form Some disregarded this feature, although it was generally admitted that heat was a very necessary adjunct to treatment Patients themselves commented gratefully on the effects of the heat in alleviating their pain

The position of the body for protection against deformity was known as the neutral or the anatomical position The body was kept all in one plane, shoulders aligned above pelvis, legs straight, on a firm unsagging bed The feet were kept at right angles, turning neither in nor out, maintained thus by splints, pillows, sandbags, or boxes The knees were usually relaxed somewhat with a small roll of toweling Some abduction of the legs was usually ordered, because the adductors of the legs were thought to be stronger than the weak abductors, which were therefore given the benefit of protection The arms were usually kept at

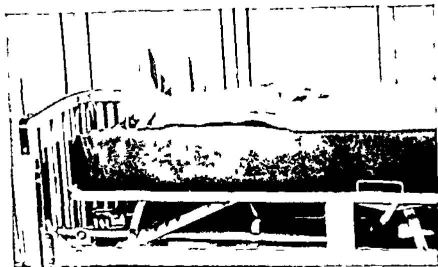


Fig 191.—Toronto splints frequently used in convalescent poliomyelitis to maintain good position of the lower extremities. The crossbar at the ankle (not visible in the picture) prevents external rotation of the limb. Note space for the heel, a likely spot for decubiti if permitted to rest on the bed.

Fig 192.—Manner of lifting paralyzed leg from splint. Note that both knee and foot are supported. This support of adjacent joints is important in the handling of any *inflamed or paralyzed limb*.

about 75 to 90 degrees of abduction, to protect the very important muscle of abduction—the deltoid—which was found to be frequently affected Unless muscle checking revealed a badly paralyzed triceps, the elbow was kept flexed



Fig 190—Manner of lifting a paralyzed arm from splint Note support of elbow and wrist (From 'Care of Infantile Paralysis in the Home A Handbook for Parents prepared by A Steindler and T J Greteman Courtesy the au thors)

Patients with severe involvement were usually kept recumbent for several months Atrophy resulted, and sometimes where immobilization was uninterrupted, stiffness of joints and surrounding structures oc curred This varied, of course, with the extent and type of treatment which had been given Certain consistent tendencies toward deformity

To describe the symptom of spasm adequately, so that the nurse recognizes that its presence is a new theory, opposed to older conceptions, it is necessary to review briefly the old concept as compared with the new For this an isolated example will be used

Formerly, poliomyelitis was thought to result immediately in a flaccid, limp paralysis The muscles so affected were weak and needed to be protected against strong healthy muscles pulling on them As an example of this we shall take the classic situation in the calf of the leg

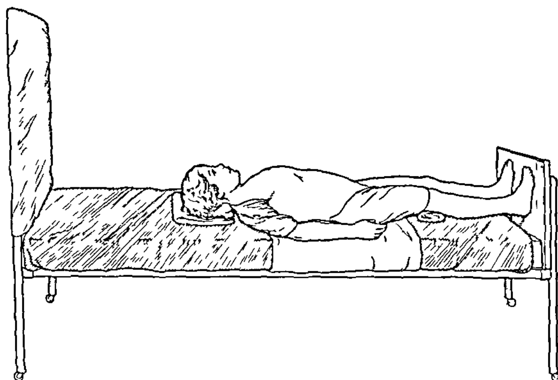


Fig 193 —Some of the equipment used in the Kenny treatment Bed with boards under mattress made up with part wool blankets instead of sheets Note space between mattress and foot of bed Footboard with blocks supporting it Hip and shoulder packs in place Other packs have been omitted for clarity Note natural rest position of the body

It was thought that in a great majority of cases the muscle on the anterior portion of the leg, the anterior tibial which dorsiflexes the foot, was affected, and that it was subjected to the pull of the unaffected and relatively stronger calf muscle, the gastrocnemius Miss Kenny, however, taught that the contracting, supposedly stronger gastrocnemius is in reality often the affected muscle, and that it is in a state of tonic contraction or spasm because it is so affected The anterior tibial muscle need not be affected at all, it is subjected to

were observed, but in the hands of experienced, conscientious workers and medical personnel, deformities could often be avoided, and gratifying return of function frequently occurred The widespread opinion in the public mind that no treatment for poliomyelitis had been evolved before the past few years is erroneous

The nurse should always bear in mind in her care of such patients, and in the critical evaluation she will make for her own personal satisfaction, that no two cases of poliomyelitis are exactly alike, and that no accurate prediction of outcome can ever be made at the onset of the disease Even a severely involved patient may recover complete function if anterior horn cell involvement is not complete or lasting No adequate system of controls is possible, for no one knows what the outcome would have been with no treatment at all Nature herself accounts for many claimed spectacular cures

Some of the above mentioned methods of treatment carry over into new methods Attention to body alignment is still important on the whole, it has not varied much, except that the arms are at the sides, not abducted and no support is placed at the feet during the acute stage. In the new treatment, as in the old, it is extremely important to handle the patient with the utmost gentleness and skill Fatigue must be solicitously avoided, no matter what system of treatment is used

FUNDAMENTAL PRINCIPLES OF THE KENNY TREATMENT

The triad of symptoms which Sister Elizabeth Kenny described as being important in poliomyelitis are spasm mental alienation, and incoordination A fourth symptom—residual paralysis—might be said to occur in case anterior horn cell involvement is severe and permanent Where this is not the case, however, Miss Kenny believed that much damage to muscle can be prevented by relieving the spasm of the muscles while the healing and absorptive processes are taking place in the cord Pain and spasm are usually linked together as one symptom although there is a tendency at the present time to consider these manifestations as separate entities since spasm may persist long after pain has been relieved

The rationale behind the Kenny treatment of poliomyelitis is based on the conception that the former theory of strong unaffected muscles pulling on weak ones was erroneous She maintained that what were considered *weak* muscles were normal and that they were subjected to pull from the *affected muscle* antagonist which was in spasm

To describe the symptom of spasm adequately, so that the nurse recognizes that its presence is a new theory, opposed to older conceptions, it is necessary to review briefly the old concept as compared with the new For this an isolated example will be used

Formerly, poliomyelitis was thought to result immediately in a flaccid, limp paralysis The muscles so affected were weak and needed to be protected against strong healthy muscles pulling on them As an example of this we shall take the classic situation in the calf of the leg

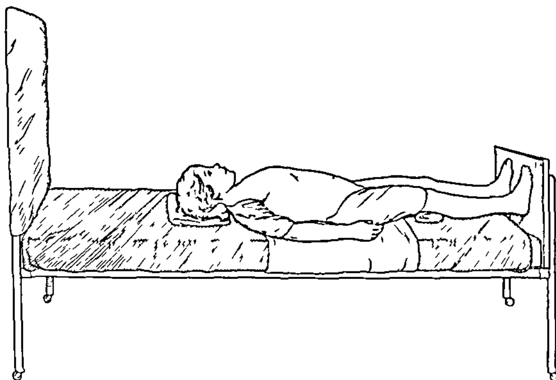


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stretching, yes, but once the spasm in the calf muscle is relieved, it would be able to resume its normal role as dorsiflexor of the foot. However, if the spasm in the gastrocnemius is *not* relieved, the anterior tibial may assume an appearance of weakness but unlike paralysis it will be unable to move the foot upward because of the *brake* on the back of the calf, which, of course, is due to the spasm of the gastrocnemius. The patient, making an attempt to lift his foot and encountering resistance, develops a conviction that he *cannot* move the foot and that it is, in fact, paralyzed. Thus, mental alienation, the second symptom of the Kenny triad, comes into evidence. Now, if the patient finds another way to dorsiflex the foot, or part of it, he will be likely to make an attempt to accomplish this in the best way he can. So, by contracting his toe extensors he might lift the forepart of the foot, thereby accomplishing at least partial dorsiflexion. This is the beginning of the third symptom, incoordination. Continued over a long period of time, this improper use of muscles for functions they were never intended to perform inevitably leads to deformity.

All treatment is aimed toward overcoming these symptoms: the hot foments or packs are designed to eliminate the pain and spasm, muscle re-education is instituted to overcome mental alienation and incoordination. Splints which were formerly used extensively are now used less frequently. However, body alignment is no less important in the new method of treatment than it was before. The body is kept in good alignment whether the patient lies prone or supine.

Modern treatment of poliomyelitis includes nursing techniques derived from both of the theories mentioned above, as well as many others. Nurses of necessity must be prepared to care for the patient adequately whatever treatment is prescribed. And it must not be forgotten that the *general* nursing care of the poliomyelitis patient is still an extremely important consideration, regardless of the local treatment employed.

GENERAL NURSING CARE OF THE POLIOMYELITIS PATIENT

The poliomyelitis patient is almost invariably irritable, hypersensitive, and apprehensive, and everything possible should be done to regulate the environment for his comfort. A quiet room, free from noise, drafts, and glaring light should be provided, and all handling of the patient—whether psychological or physical—should be skilled and gentle. Every effort should be put forth to reassure the patient as to his condition and his treatment. He must be told in advance about new features of his

nursing care which might be a source of alarm to him. The initial treatments must be done with the utmost gentleness, however, or no amount of reassurance will establish confidence.

The patient's bed should be of the proper height to make caring for him as easy as possible for the nurse or mother. Blocks for elevating the bed may need to be prepared in the home for this purpose. The bed should be made firm with boards beneath the mattress. A footboard should be prepared for the foot of the bed. It should be higher than the patient's feet, in order to prevent bedclothing from resting on the toes. The footboard should be separated from the mattress by two blocks of wood wide enough to provide a trough for the patient's heels, which should not be allowed to rest on the mattress. Portable footboards or boxes are more suitable for children's wards, because the child in the full size bed tends to squirm about considerably if he is out of line with his ward mates, as he will be if his body must be pulled down so that his feet can contact a footboard at the foot of the bed. Foot supports frequently will need to be altered to meet the needs of the individual patient, with the angle sometimes increased or decreased to accommodate weak or paralyzed muscles.

The mattress should be covered with a waterproof material, and blankets—preferably part wool—are used to make the bed rather than sheets, since they are more absorbent and less likely to chill the skin. Chilling in poliomyelitis is always to be avoided, as it tends to increase muscle spasm. A draw sheet is placed beneath the hips, and another beneath the head. Upper covers should never press on the toes or upon sensitive portions of the extremities. A cradle may need to be provided to eliminate this, although the footboard may prove sufficient for the purpose. A pillow should not be used during the acute stage, but if the neck muscles are in spasm, some support may be needed for this area. A small rubber air ring, partly inflated, may do this, or a child's white cotton stocking may be stuffed with cotton and made into a ring for this purpose.

The patient is usually more comfortable without gown or pajamas. A loin cloth or T binder will be sufficient for children, but girls or women will need a vest or brassiere.

Observations to be Made on Admission.—Nurses should be alert for early manifestations of respiratory or bulbar involvement when the patient is admitted. Shallowness of breathing, increased breathing rate, rigidity of the chest or abdominal muscles, an exaggerated thoracic cleft, or ballooning of the abdomen should be reported to the physician im

mediately Any signs of hoarseness, inability to swallow, a nasal twang to the speech (resembling the speech of a patient with a cleft palate) may be indications of involvement of the pharyngeal muscles These are extremely important signs and the physician should be notified without delay

Nurses should seek to ascertain from the parents information regarding the child's bowels and bladder Temporary impairment of these organs is not uncommon, and constipation and retention may need to be dealt with very early in the course of the disease Intake and output should be carefully recorded during the acute period

The observations of the nurse are of great importance not only when the patient is admitted but throughout the course of the disease Nurses should learn to inspect the patient's body intelligently before applying packs, or, if baths are given, when giving the bath With a little practice they will be able to detect increase or decrease of spasm in various muscles Any position which is maintained by the patient over a long period should make the nurse suspect the presence of muscle spasm in that area Abnormal skin creases or grooves, prominence of tendons hypersensitiveness to touch, or limitation of motion are significant findings and should be recorded

Dietary Needs of the Poliomyelitis Patient —Since the patient will have fever, and since in all likelihood he will be receiving hot packs which are dehydrating the patient will need fluids in large amounts during the acute stage of the disease Salt is usually prescribed during humid weather, because large amounts of this substance are lost in perspiration Liquid diets are somewhat low in salt unless soups and broths are included in them Any tenacious liquids, such as eggnog and thick syrupy fruit juices are usually not well received and should be avoided When the patient is free from nausea, if there is no respiratory or bulbar involvement, a normal diet may be given if the patient will tolerate it Diet may need to be somewhat guarded if the patient tends to gain weight easily for gain in weight will put an added burden on weakened muscles

In giving fluids care should be taken not to lift the head of a patient who has spasm or rigidity in the posterior neck muscles A spoon is better than a cup or drinking tube during this period If the patient is able to feed himself, nurses should use considerable thought and planning to devise positions which will make it possible for the patient to feed himself without increasing spasm or tightness in affected muscles

Elimination in Early Poliomyelitis —Enemas are sometimes ordered routinely on admission for all poliomyelitis patients, as it has been found

that constipation in the early stages of the disease is very common Considerable improvement may often be observed as a result of adequate bowel elimination shortly after admission

The placing of the bedpan is one of extreme importance to the patient's comfort If this is done hastily and with no thought of supporting the dependent portions of the patient's body while the hips are on the bedpan, the patient may ever afterward dread to use the pan It is important that the patient with acute poliomyelitis should not be allowed to arch his back in getting on or off the pan It is usually more comfortable for the patient if he is turned to his side carefully, with the body in good alignment Pillows are then placed along the back and thighs, leaving a space for the bedpan, which is put in place before the patient is returned to his back Turning must be done without twisting, and care should be taken to see that the patient's body is on the same plane as the pan

RELIEF OF MUSCLE SPASM

Methods of using heat to relieve muscle spasm vary greatly in different localities Many modifications in the original method propounded by Miss Kenny have been brought about Nurses must be guided entirely by the physician's preference in using this treatment, as well as by the patient's tolerance Parts to be packed and frequency of packing should be prescribed by the physician as any other treatment would be prescribed Some patients cannot stand a full schedule of hot packs, and alterations of treatment may need to be used The outline given below is not to be regarded as a "system" of treatment, but only as a suggested schedule which will need to be modified according to the needs of the patient A rigid, ritualistic program of treatment, without individualization for each patient, is a very dubious procedure

General nursing needs must never be neglected because of the attention that must be given to packing Packing is not the end all of treatment in poliomyelitis and should never be thought of in that light

Equipment for Giving Hot Moist Packs —

a Some type of equipment for heating the packs a hot pack machine, an electric washer with ringer, a mop bucket with wringer attached, an electric roaster, or a large double boiler The latter is most satisfactory for heating single packs If none of the above is available, a stove and kettle for boiling the packs may be used, with a hand wringer attached nearby In the hospital, service room sterilizers are commonly used

b Blankets of 60 to 100 per cent wool for inner moist packs

c Material for outer packs—all wool if available, wool and cotton may be used

d Waterproof material for covering inner pack, may be any of the new plastic materials now on sale, oiled rayon, oiled silk, old shower curtains, or old raincoats

e Bed with boards beneath the mattress

f A firm mattress, four to five inches shorter than the bed, small blocks of wood are used at the foot to keep the mattress away from the foot of the bed

g A footboard attached to the end of the bed by means of ropes threaded through openings in the board and fastened to the end of the bed Should extend at least three inches above the feet Quite frequently the footboard and the blocks described above are attached for ease in handling

h Binders, abdominal and chest

i Safety pins and emery board for sharpening them *Container for* safety pins when packs are removed

j Canvas restraints may be necessary for small children

If packs are heated in the utility room sterilizer, the following procedure is usually found to be satisfactory The packs are moistened throughout with water and are wrung out through a tight wringer before being placed on the tray of the sterilizer, which is so placed that it does not come in contact with the water in the bottom of the sterilizer They are then heated thoroughly, removed from the tray with a long forceps and immediately surrounded with rubber sheeting and taken to the bedside No water should be placed in the tub or bucket which the nurse carries to the bedside, as boiling water in such containers makes them very heavy and likely to spill or splash as they are moved

The packs are sometimes sprinkled with about one half cup of water in places where no wringers are available Packs placed in the sterilizer dry do not absorb sufficient moisture to make them entirely satisfactory

Packs are cut to fit the part to which they are to be applied Careful measurements should be made so that they will be large enough to include all the muscles of the part but not so large that they will cover joints Triangle shaped packs are usually preferred for the hip and shoulder, while the packs for other areas are rectangular or square in shape *

If packs are kept in individual net bags or wrapped in bundles there is little risk of using one patient s packs for another There is some

*Information pertaining to care of the poliomyelitis patient may be obtained from the Nursing Advisory Services for Orthopedics and Poliomyelitis of the National League of *Nursing* Two Park Avenue New York N Y and from the National Foundation for Infantile Paralysis 120 Broadway New York N Y

danger in mixing packs, unless they are thoroughly sterilized between applications, as the *common* exanthemata of childhood can be spread rather easily in a children's ward through carelessness of this sort Packs should be folded and sterilized early in the morning, and this is frequently done by the night nurse They should be washed with soap and water at stated frequent intervals, and dried, preferably in the sun The danger of resistant spore or fungus growth *on these* blankets *must* be borne in mind

No oil or lubricant is used to protect the skin, as there is no danger of burning if the packs are wrung dry enough Baths are usually not given during the stage of acute muscle spasm, and back rubs are omitted These two features of nursing care tend to increase spasm in involved *muscles and are, of course,* dispensable Local baths after the use of the bedpan will be sufficient

Technique of Applying Packs —In applying the hot foments for treatment of the muscle spasm, certain principles should be borne in mind (1) The foments should be *hot,* not lukewarm (2) They should be wrung completely free of moisture This cannot safely be done by hand *or by stupe wringer If a hot pack machine is not used, packs should* be wrung through a *tight* wringer twice (3) They should not cover joints, for they must not give the patient any sense of being unable to move (4) They should cover the muscle in its entirety, not merely the muscle belly

If these rules are observed, there seems to be no reason for any particular ritual of procedure However, speed, efficiency, and accuracy are usually obtained to a greater degree if certain methods are described for the use of all Furthermore, the handling of the patient must be kept at a minimum Gentleness in handling to avoid pain and apprehension *is necessary* whether one *is aiming* to prevent stretching of paralyzed muscles or further spasm in the affected ones It must be remembered always that the pain in the initial stages of the disease is intense, and that the patient s response to it is one of dread and sometimes hysteria Crying, protesting, and lack of cooperation in patients with this disease have a very real cause *It is urged that the first* manipulation the patient has at the nurse's hands should be particularly gentle so that no defense response may be set up against further treatment

This being the case, packing must be done with as little unguarded or unnecessary movement of the patient s body as possible The body should be *moved all in one* piece With the patient supported on his side, facing the nurse whose hands support shoulder and hips, a second nurse can

apply packs to back, shoulder, and hip A team of three, with an assistant to wring out the hot packs, is highly desirable for speed and efficiency, particularly when many patients must be packed

The outer dry woolen pieces may be stitched to the waterproof pieces to save one step in wrapping These pieces are laid in readiness on the bed before the moist packs are brought to the bedside The moist packs are applied without delay, but when the pack is removed from the machine or wringer, it is advisable to spread it out for a moment in order to eliminate pockets of steam The first pack of the day should not be as hot as later ones, when tolerance to the heat will have been built up somewhat After the moist pack has been wrapped about the part the dry packs are rapidly put in place and pinned

The packs are large enough to encompass the area for which they are intended, but they should not be heavy Additional layers of material add bulk and weight to the patient and must be used conservatively Cotton bath blankets or bath towels are particularly likely to be weighty and should not be used

A breast binder with straps and an abdominal binder are used to hold the chest, back, and abdominal packs in place All packs and binders are securely pinned Packs are neat and secure when finished They do not sag or fall off no matter what the patient's activity However, abdominal binders should not be placed low enough to restrict hip movement, and the breast binder must not be too tight or it may inhibit respiratory excursion

There is some variation in the sequence of applying the packs, based largely on personal preference Hips back abdomen, shoulders, neck, and chest are frequently done first, followed by the packing of forearms and hands lower legs and feet Particular attention is paid in applying shoulder and thigh packs that the origins of important muscles are included The apex of the triangle (or square) used on the shoulder should point upward toward the mastoid region A second point of the foment tucks snugly into the axilla to encompass the pectoral insertions The under angle or point of the foment is brought up and pinned along the shoulder The elbow is left free

For the thigh pack the point of the triangle (or square) is placed three inches above the crest of the ilium A second point tucks down smoothly over the thigh and contacts as much of the adductor tendons as possible The under portion of the foment is brought up medially and is pinned over the upper thigh The knee is left free

The neck pack does not encircle the throat nor cross tightly under it A long narrow strip of blanket material is placed so that its center portion is on the back of the neck, and the two ends are brought over the shoulders to be pinned to the chest pack This is an important point, as some respiratory embarrassment might occur if a snug pack were put circularly about the throat

A full schedule of packing will usually include packs at two hour intervals from 8 A M to 8 P M Intermissions between packs are usually only long enough to remove the cooled packs and apply the hot ones An exception to this during the day is the period when muscle re education is carried out Packs are not applied at night except where spasm is so acute that respiratory failure is threatened, or where persistent pain in the muscles is a source of discomfort and restlessness to the patient

In packing periods and between, strict attention should be paid to the bed position of the patient During the period of painful spasm, however, it is generally permissible to allow the child to lie in the position which is most comfortable to him This is permitted until packing has relieved some of the spasm and pain For example, if spasm in the back muscles had brought about hyperextension of the spine, the body would be supported in that position with pillows until the spasm was released Thus, in face lying, pillows would be placed under the shoulders and thighs, and packs applied to the back and legs in that position If spasm were present in the hamstrings and hip flexors pillows would be used beneath the thighs and lower legs until relief of spasm was obtained However, the goal to be worked for is the natural rest position For back lying this is one in which the body approximates the standing position Arms are at the side, the trunk—shoulder and pelvis—are in one plane The legs are straight, the knees slightly relaxed, the feet neither inverted nor everted *As long as spasm continues in the muscles of the legs, the feet are not placed against the footboard,* as this also tends to increase the spasm When spasm of the leg muscles is relieved so the patient can dorsiflex his feet to 90 degrees without discomfort, the feet are placed against this board and kept there whether the patient lies prone or supine

During the period of acute pain and illness, only superficial examination of the body can be made to determine the parts in spasm Examination at this time is done usually without palpation by visual analysis *only* Muscles in spasm will appear to be shortened, sometimes assuming a ropelike prominence Sometimes, particularly along the outer aspect of the thigh, it is possible to outline the entire muscle, so distinct is its

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If parents and volunteers are not informed of these facts, they will sometimes change packs more frequently than ordered and will place hot water bottles along the packs to keep them hot, feeling that this will hasten the child's recovery

Precautions to Observe During Packing—Any patient who is receiving hot applications needs careful nursing observation If the atmosphere is of high humidity, prostration may occur rather easily A seriously ill patient may become prostrated from the use of heat at any time Careful checking, therefore, should always be made of the pulse, temperature, and amount of perspiration Any irregularity or threadiness in the pulse, alteration of depth of rate of breathing, cyanosis, or pallor indicates that treatment should be discontinued until the doctor can be contacted Sometimes cool sponging between packs may be given Circulation of air should always be provided in the room where packing is done, although drafts, of course, must be eliminated

Packs themselves may be the cause of deformity if they are applied unskillfully or are too heavy A heavy pack on the thigh sometimes causes the child to lie in a position of outward rotation that is not due to his condition at all, but to the weight of the pack Nurses should frequently inspect the parts of the body being packed to see that no mechanical obstruction to good bed posture exists

Alterations in pack treatment are frequently necessary If the patient does not tolerate hot packs, alternate hot and cold packs may be ordered Cold sprays between hot packs have been used, and occasionally only one or two packing periods a day may be ordered The skin is allowed to rest between these packing periods It should be left exposed to the air if any tendency to maceration is observed

Itching may prove a troublesome factor as some individuals do not tolerate contact with wool A thin layer of gauze may be placed around the skin before the pack is applied and in some instances this will give considerable relief

Immersion of the patient in a hot tub daily, or even oftener, is becoming a preferred method of treating muscle spasm in many localities This is true particularly in areas where the disease affects small children Young children tolerate these tubs better than hot moist packs in humid summer weather

Drugs Used in Treating Muscle Spasm—In the past few years certain drugs have played an important part in the treatment of poliomyelitis Although some differences of opinion exist among medical men

appearance from the spasm It is, of course, the doctor's responsibility to order the packs for the specific muscle which he recognizes to be in spasm However, routine orders may exist for immediate packing of spine and neck and hamstrings in all new cases, since it is recognized that these groups are almost always in spasm in the early days of the disease

Prone and Lay on Packing —There is an increasing tendency to use lay on packs to alternate with pin on packs, particularly where spasm persists in certain areas of the body These packs have the advantage that the patient need not be turned or manipulated during their application Prone packing is particularly adaptable for stubborn spasm of the muscles of the back and thighs The patient is placed in the face lying position in good bed posture, with supports to areas where tightness exists, and the packs are applied by laying them on the parts without pinning No special packs need to be cut for this, as the back, thigh, and calf packs are used They should completely cover the posterior area of the back and should be tucked in at the sides

The anterior surface of the body may be treated in the same fashion where there is need for intensive packing to relieve stubborn spasm This may be a particularly important form of treatment where involvement of the respiratory muscles exists Packs may need to be changed as often as every five minutes for short periods Care must always be taken not to tire the patient during these intensive periods of packing

The term continuous hot packs" is misleading and this fact should be clearly explained to parents and volunteer workers Light cradles, hot water bottles or heating pads are not used with the packs, as it is not desirable that the packs remain at the same temperature during the entire period they are on the patient The gradual cooling of the packs is considered to have a tonic effect on the muscles Hot moist packs are beneficial in that they tend to increase the blood supply to the part during the early period following their application, but, as they cool, the blood vessels contract and in this way assist markedly in the elimination of fatigue products from the muscles This will not occur if the packs are kept at the same temperature all the time they are on the patient Furthermore the skin of most individuals will not tolerate continuous hot moist packing particularly if the packs are kept on both night and day Maceration of the skin or sudamina tend to occur after a few days of such treatment and itching may become excessive because of the constant contact with wool The skin needs periods of freedom from both wool and moist heat for maintaining its integrity

part of the nursing duties after demonstration has been given by the physical therapy department Passive joint movement is usually done several times during the day and it is felt that it is sometimes more convenient for the nurse to do this because of her frequent contacts with the patient Every effort is put forth to maintain complete range of joint motion in all joints from the earliest days of the disease All passive motion must be kept below the pain level, with the possible exception of those done following curare administration where upon specific instruction from the physician the range is sometimes carried beyond the point of pain

While physical therapy treatment in poliomyelitis has been much modified in the past few years, the following will give the nurse a concept of some of the aspects of present day physical therapy in the treatment of poliomyelitis

1 The earliest step in muscle re education is called tendon stimulation It consists of several rather quick passive movements of the joint through a limited arc and without the patient's assistance It is done until the tendon of the muscle can be observed visually or through touch The purpose of this step is to stimulate the proprioceptive impulse It is done very early in the course of the disease, perhaps on the third or fourth day but it is not started while painful spasm is present

2 When spasm has been overcome to the extent that pain is completely relieved, a careful system of muscle re education is begun One of the main purposes of this muscle training is to continue, or to redevelop, awareness in the patient's mind of the normal rhythmical movement of muscles His constant attention and concentration on the movement are a vital part of the exercises Origin and insertion of the muscles are pointed out to him each time the movement is begun He thinks through the movement as the operator performs it passively Passive exercise alone may be done for many weeks until the patient demonstrates the ability to do this action himself, unconsciously From then on he does this movement under the guidance of the technician, definite emphasis being placed on the patient's cooperation and concentration during the activity If incoordination occurs, active muscle training is discontinued immediately Great care is taken throughout the exercises to avoid the use of substitute muscles in performing any action, and also to keep the patient aware of the normal movements of joints Emphasis is placed not so much on increasing the strength of the muscle as on establishing coordination

regarding the effectiveness of these drugs, nurses called upon to administer them should be acquainted with the dosage, desired effect, and possible toxic reaction

Neostigmine (Prostigmine) has been used in an attempt to decrease muscle spasm, either in conjunction with hot packs, or without them in cases where moist heat is not well tolerated It is usually given hypodermically in dosages varying from 0 5 to 2 5 mg, according to the age of the patient Its use by mouth has been rather unsatisfactory, although it is still given in that manner occasionally Atropine may be given at the same time, in order to eliminate certain parasympathetic symptoms, such as nausea, diarrhea, and urgency which often accompany the use of neostigmine Twitching of the face, arms, and chest muscles sometimes occurs after administration of the drug and rarely, substernal pain and emotional distress Maximum benefit from this drug is said to be obtained in from twenty to sixty minutes

Curare has also been used rather widely for the relief of muscle spasm The dosage is around 0 9 mg per kilogram of body weight, and the drug is administered intramuscularly Orders will usually be left to carry out a full range of joint movement on the affected extremities after curare is given and nurses should ask for very specific instructions regarding these exercises Some physicians desire that the range of joint motion given following curare should be beyond the pain level but nurses should have a clear understanding of just what the physician expects in this matter before they undertake to carry out such treatment

Since the dosage of curare is based on body weight, care must be taken to check on the patient s weight frequently, in order to determine if an accurate dosage is being given The use of curare in bulbar poliomyelitis is considered hazardous, and the margin of safety of the drug in any case is extremely narrow requiring keen observation on the part of the nurse to prevent toxemia Any symptoms, however mild, of respiratory embarrassment, such as shallowness decreased rate, dyspnea or cyanosis must be reported to the physician at once

Physical Therapy in Poliomyelitis —In order that the patient's treatment may be closely coordinated, nurses should have a clear concept of what the physical therapist is seeking to accomplish in poliomyelitis In some localities all of the physical treatment of the poliomyelitis patient, including hot packing is considered the responsibility of the physical therapy department However, hot packing it usually done by the nursing service Early passive joint movement to all joints may also be

part of the nursing duties after demonstration has been given by the physical therapy department Passive joint movement is usually done several times during the day and it is felt that it is sometimes more convenient for the nurse to do this because of her frequent contacts with the patient Every effort is put forth to maintain complete range of joint motion in all joints from the earliest days of the disease All passive motion must be kept below the pain level, with the possible exception of those done following curare administration where upon specific instruction from the physician the range is sometimes carried beyond the point of pain

While physical therapy treatment in poliomyelitis has been much modified in the past few years, the following will give the nurse a concept of some of the aspects of present day physical therapy in the treatment of poliomyelitis

1 The earliest step in muscle re education is called tendon stimulation It consists of several rather quick passive movements of the joint through a limited arc and without the patient's assistance It is done until the tendon of the muscle can be observed visually or through touch The purpose of this step is to stimulate the proprioceptive impulse It is done very early in the course of the disease, perhaps on the third or fourth day, but it is not started while painful spasm is present

2 When spasm has been overcome to the extent that pain is completely relieved, a careful system of muscle re education is begun One of the main purposes of this muscle training is to continue, or to re develop, awareness in the patient's mind of the normal rhythmical movement of muscles His constant attention and concentration on the movement are a vital part of the exercises Origin and insertion of the muscles are pointed out to him each time the movement is begun He thinks through the movement as the operator performs it passively Passive exercise alone may be done for many weeks until the patient demonstrates the ability to do this action himself, unconsciously From then on he does this movement under the guidance of the technician, definite emphasis being placed on the patient's cooperation and concentration during the activity If incoordination occurs, active muscle training is discontinued immediately Great care is taken throughout the exercises to avoid the use of substitute muscles in performing any action, and also to keep the patient aware of the normal movements of joints Emphasis is placed not so much on increasing the strength of the muscle as on establishing coordination

Massage is seldom given in the acute stages of the disease because of its tendency to increase spasm Warm pool treatment or hot tub baths are sometimes given several times during the week as part of the physical therapy treatment Intensive packing of tight or contracted muscles, followed by forcible stretching, may be done after the acute period of pain and spasm is over

BULBAR INVOLVEMENT

The term bulbar is used to designate involvement of the brain stem, which, nurses will remember, has the following parts the medulla, pons, and midbrain Strictly, the term bulbar should probably be applied only to involvement of the medulla, or bulb, but it is now used to cover all types of involvement above the cord

There are apparently many types of bulbar involvement Three of these will be discussed briefly The largest group is that in which the nuclei of the cranial nerves are affected If the tenth cranial nerve is not involved, this type may not be a serious threat to life, although *facial palsy and paralysis of the external ocular muscles may result* If the tenth cranial nerve (the vagus nerve) is affected, however, abductor paralysis of the vocal cords may present an extremely grave complication Laryngoscopic examination may reveal that the cords are adducted to the midline, with almost complete occlusion of the airway Prophylactic tracheotomy is usually done when this type of involvement is anticipated to prevent obstruction in breathing It is now felt that even a short period of anoxia has a profoundly deleterious effect on nerve cells and may of itself be a large factor in hindering recovery Furthermore it has been noted that an obstructed airway accompanied by the deep, almost gasping inspiration necessary to get oxygen into the lungs may result in acute pulmonary edema, a frequent and often fatal complication of bulbar paralysis

The patient developing this complication will usually present a picture of progressive toxicity He is likely to be apprehensive, excited, and overactive He will shortly reveal symptoms of dysphagia and dysarthria, and oral secretions will be found to be pooling in his throat Immediate treatment will be necessary to save his life Treatment will usually consist of tracheotomy and oxygen administration, combined with constant and skillful nursing

Another very grave situation, and one for which nurses caring for poliomyelitis patients should always be alert is involvement of the respiratory center in the medulla This may be a late complication and

has been known to occur as long as a week after other bulbar symptoms have been recognized and treated It may occur even after tracheotomy Sudden disturbances of the mechanics of respiration with variations in depth, rhythm, and rate, and periods of apnea may be noted This is considered to be an indication of oxygen starvation and will often require the use of the respirator as well as increased oxygen concentration For limited periods, oxygen may have to be used in a 100 per cent concentration

In addition to alterations in the respiratory pattern, the nurse might be aware of personality changes in the patient, he may become stubborn, demanding, and uncooperative Cerebral anoxia is said to be the cause of this personality change

Another type of involvement sometimes seen during a poliomyelitis epidemic is known as polioencephalitis These patients, as a rule, do not show facial palsies or cranial nerve disturbances, nor do they manifest swallowing or breathing difficulties They may, however, show extreme apprehension and excitement These are the patients who become so 'difficult" after the first period of the disease has passed, and who are so often referred to as unmanageable and neurotic Because they are often supposed to be progressing nicely before these conduct changes occur, they are sometimes even disciplined in an effort to make them more cooperative However, if the nurse takes the time to observe these patients closely, she will often detect tremors, twitching, myoclonic movements, and abnormal flushing of the face Treatment for this type of involvement is immediate discovery of the cause, followed by indicated treatment Early reporting is thus of great importance

Combination spinal cord and bulbar involvement is not uncommon in epidemics The respirator may be needed for these patients during the early stages of the disease, but great care will be taken to ascertain that the air passages are open before placing the patient in the machine If there is blocking of the airway, tracheotomy will have to be done, or the action of the machine may result in severe pulmonary damage

A patient who has had a tracheotomy, and who must also be placed in the respirator, is a nursing problem of considerable magnitude The most expert and conscientious type of nursing service is indispensable The respirator may be tilted at intervals (approximately 30 degree angle) to promote drainage of secretions and to aid somewhat in extending the neck so that the operated area is free from contact with the collar However, signs of edema must be watched for whenever the foot end of the respirator is elevated Modifications have been made

in respirator collars to accommodate tracheotomy patients One such modification is a 20 inch sponge rubber collar with a depressor which can be clipped on to push the collar down from the patient's chin The sloping front respirator is also helpful in the care of the tracheotomy patient

Nursing Care in Bulbar Involvement—Medical treatment and nursing care in bulbar poliomyelitis are based on four considerations preventing asphyxia, averting exhaustion, maintaining adequate nutrition, and checking secondary infections

Since, in an epidemic, bulbar cases may be expected to occur with considerable frequency (some workers place the figure as high as 20 per cent), nurses should be alert to the signs of such involvement in the early stages of the disease, for immediate treatment may be necessary to save life

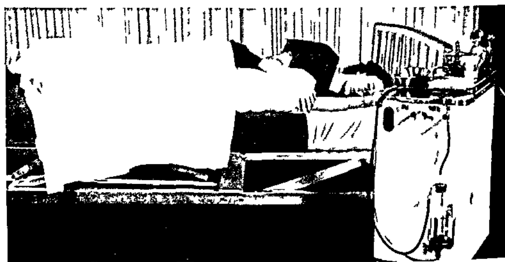


Fig 194—*In bulbar poliomyelitis nursing measures are directed toward keeping* the airway open and free of mucus The foot of the bed is elevated to provide a postural drainage position The patient is placed on his side and the position of the head and neck must be one that will permit drainage of secretions Suction apparatus with rubber catheter and oxygen equipment are kept available

The onset of the bulbar type of paralysis may frequently be so abrupt that no symptoms at all are noted until the development of a nasal voice and difficulty in swallowing become apparent The disease in these cases is usually severe and fulminating and may result in death within twelve hours

Usually, though, certain early symptoms may predict such involvement, and the nurse should be familiar with them Symptoms do not

always descend on the patient within an hour's time There are often significant prodromal manifestations which should give their warning Restlessness, wakefulness, an increase of mucus in the throat, difficulty in swallowing, drawing back of the head, rigidity, and an expression of apprehension are significant and should be reported without delay Choking, exhaustion, and cyanosis are late symptoms, the physician should be notified before they occur Meanwhile, elevation of the lower end of the bed may prevent choking from an accumulation of secretions in the throat and is usually considered an immediate nursing duty in these cases

The bulbar form of paralysis may also manifest itself in foamy saliva, tenacious sputum, crowing respiration, nasal voice, hoarseness, limited excursions of the ribs, and inability to expectorate mucus Somnolence may also occur The patient tends to breathe shallowly, fearfully, lest he choke in the process

Skill and self control on the part of the nurse are paramount to prevent panic, and to keep the patient as quiet as possible Threatened loss of breath is one of the most terrific crises any human being ever encounters, and the nurse should recognize this and attempt to cope with it to the best of her ability Choking attacks, causing anoxemia, aspiration of secretions, and excessive fatigue are ever present dangers of which she should be cognizant as she works with these patients

These cases are often swiftly fatal, but if the patient can be carried through the acute period until fever has subsided, he will usually survive The situation during the acute stage is analogous to suffocation or strangulation Once this constriction is moved, the patient tends to recover Danger of fatigue is great because if the patient relaxes for a moment, he is likely to be wakened by choking attacks caused by his pharyngeal secretions Fear of this keeps him constantly awake and apprehensive Sedatives are sometimes ordered to prevent exhaustion, but the nurse will recognize the urgent necessity she has of keeping check on the respiratory rate of her patient after morphine Marked decrease in the number of respiratory excursions per minute should be reported

Tube feeding is not usually considered advisable during the stage of acute distress because of the danger of vomiting Nasal feeding is attended by risk in any situation, but when complicated by pharyngeal edema and the hyperirritability of the patient with bulbar poliomyelitis, it seems too great a responsibility for the nurse to assume However, since tube feeding may be necessary after the acute stage has passed, a

few rules for nasal feeding are included here for the use of the nurse, who is asked to do this type of feeding.

1. If it is customary for the tube to rest in ice or cold water before use, be sure that all water is drained from the tube before it is inserted.
2. If a lubricant must be used, some type of surgical jelly is preferable. Do not use oil.
3. The funnel attached to the catheter should be inverted over a pan of water. If bubbles are seen or heard, withdraw the tube.
4. If the patient chokes or regurgitates, the tube must be removed at once. The patient is to be rolled to his side if he is not already in that position.
5. If the patient forces the tube out partway, do not reinsert it. It is better to start over from the beginning.
6. When removing the tube, do so quickly, but only after you have passed water through it and have trapped the remaining water in the tube by firmly pinching off the tube. This latter is extremely important.

When nausea subsides, it is usually considered safe to begin fluids by mouth, but fluids should be given guardedly, a teaspoonful at a time, to make sure no aspiration takes place. Milk is contraindicated as it seems to form a tenacious phlegm in the throat. To cut persistent mucus, Sister Kenny used a mixture of brandy, egg white, and water.*

Nursing care for these patients will usually include postural drainage by elevation of the foot of the bed to a 20 to 40 degree angle, placing the patient on his side, sometimes with the head slightly over the side of the bed. The prone position is usually considered unwise because it may somewhat restrict chest movement. Suctioning is done to prevent choking on the oral secretions which collect in the throat. It must be done with great gentleness and skill. A soft rubber catheter is used, and the suctioning is done only as often as is necessary, for sometimes the procedure serves to excite the patient and exacerbate his symptoms. Some physicians prefer constant to intermittent suction because of this factor. Since fluids accumulate most heavily in the side of the throat on which the child lies, the suctioning catheter should be aimed at this area.

To eliminate the chance of aspiration, food and drink are usually withheld as long as there is nausea. Parenteral feeding or transfusions of whole blood may be given. Care is exercised, however, to limit the amount of fluid given by vein since there appears to be some evidence that too liberal use of fluids may be inadvisable, particularly where cerebral edema may already be present.

* One egg white, cut several times, 2 tsp. brandy, ¼ tsp. sugar, and ½ cup water.

Oxygen may be ordered, and it may be given by tent, mask, or nasal catheter. If it is administered by catheter, it will be necessary to allow each nostril periods of rest from contact with the rubber to prevent irritation of the mucous membrane. The catheter is usually taped to the forehead, while the suction catheter is best taped to the chest.

Hot packs are occasionally ordered to the back and neck if the patient is not in too great a state of excitement. Sometimes release of spasm in these areas allows the patient to swallow with greater ease. It is exceedingly difficult to swallow with the head held in a position of hyperextension. Care should always be used not to tire the patient with packing. Only lightweight wool packs, covered with waterproofing, are used.

Mortality in bulbar involvement is high, but, if the patient survives the acute stage of the disease, he tends to recover with remarkably little residual involvement. Occasionally, however, a weakness may occur in the throat muscles, often accentuated by fatigue or overexertion, but this can usually be overcome by careful attention to the child's rest habits and by modifying the diet so that numerous small meals are given instead of infrequent large ones. Food should be ground and tenacious fluids avoided.

NURSING CARE AFTER TRACHEOTOMY

Tracheotomy has been done quite frequently in recent years on patients in whom paralysis or spasm of the muscles of the larynx threaten to occlude the airway and has unquestionably saved the lives of many patients.

The poliomyelitis patient who has had a tracheotomy needs the same care to his tube and wound as a patient who does not have poliomyelitis. Nurses have learned these techniques in other services, and they will not be repeated here, except to reiterate general principles. The nurse must be alert to wipe mucus and tracheal secretions from the tube as soon as they appear and to use the suction machine when necessary to prevent coughing and restlessness. It is, however, usually considered advisable to avoid too frequent suctioning when oxygen is being given through the tube, as suctioning interferes with continuous oxygenation. Extra catheters for suctioning and for oxygen administration must of course be available. Skill in removing and cleaning the inner tube when the necessity arises is important. Somewhat greater emphasis is placed on air humidification in poliomyelitis than is necessary for other types of

few rules for nasal feeding are included here for the use of the nurse, who is asked to do this type of feeding

1 If it is customary for the tube to rest in ice or cold water before use, be sure that all water is drained from the tube before it is inserted

2 If a lubricant must be used, some type of surgical jelly is preferable Do not use oil

3 The funnel attached to the catheter should be inverted over a pan of water If bubbles are seen or heard, withdraw the tube

4 If the patient chokes or regurgitates, the tube must be removed at once The patient is to be rolled to his side if he is not already in that position

5 If the patient forces the tube out partway, do not reinsert it It is better to start over from the beginning

6 When removing the tube do so quickly but only after you have passed water through it and have trapped the remaining water in the tube by firmly pinching off the tube This latter is extremely important

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restriction of the pectorals Primary treatment in this event is directed toward release of the spasm in the pectorals Hot moist lay on packs are applied to the chest and renewed every few moments until the tightness in the chest muscles is relieved As soon as the spasm is relieved, the patient is taught breathing exercises, and effort is made to eliminate the use of the auxiliary muscles, such as the sternocleidomastoids and platysma, in breathing

If spasm of the diaphragm is present, the patient frequently prefers to lie on his left side He is kept as comfortable as possible in this position, with knees and hips flexed, and a pillow is placed between the thighs to keep the upper hip from sagging downward A pillow is also used to support the upper arm at shoulder level, to increase chest capacity to the maximum Packs extend over chest and abdomen from axilla to pubis The posterior neck and back are usually packed concurrently The breathing exercises taught these patients consist of instruction to breathe in through the nose, while the nurse places both her hands high on the chest and asks patient to fill the chest out at that spot The patient is then told to breathe out through the nose, pull the ribs together, and tighten the abdominal muscles

It is advisable to give an enema to all patients with diaphragmatic spasm soon after admission Nurses, remembering the physiology of respiration, will understand that because of the tonic contraction (spasm) present in the diaphragm in these cases, the capacity of the thorax will be increased, whereas the persistent lowered position of the diaphragm will decrease the capacity of the abdominal cavity The necessity for relief of any distention in the abdomen will become apparent when viewed in this light

It is the physician s task, of course, to make the distinction between spasm" and alienation" in the respiratory crisis, and treatment will be based entirely on his findings

CARE OF THE PATIENT IN THE RESPIRATOR

The respirator is used most commonly and successfully in intercostal or diaphragmatic paralysis Stimson's comments upon the use of the respirator are significant "It should be administered only by experts, for unwise respirator treatment may predispose the lungs to subsequent collapse or infection leading to an almost inevitably fatal pneumonia or massive atelectasis within a few months "*

*Stimson Philip Manual of the Common Contagious Diseases Lea & Febiger 1936 by permission

patients Unless the air is moist, the mucus in the trachea tends to become viscid and resistant, and suction will be very difficult Humidifiers must be kept in the patient s room if oxygen is not being given It is felt, however, that it is much more satisfactory to administer moistened air and oxygen combinations through a tracheotomy inhalator

The nurse must be constantly alert for signs of further complications of the disease paralysis of the extremities, of the chest muscles, of the respiratory center, or signs of incipient polioencephalitis

The patient will need gentle handling and constant reassurance The importance of the nurse's continued presence at his bedside can hardly be overemphasized A calm attitude and quickness to understand the patient s needs contribute immeasurably to his comfort and security

To prevent sepsis in the trachea and lungs, penicillin, nebulized in a saline solution, may be ordered for administration through the tracheotomy tube Penicillin is also sometimes given intramuscularly as a prophylaxis against secondary infections

INVOLVEMENT OF THE MUSCLES OF RESPIRATION

In the spinal type of poliomyelitis, or in the combined spinal and bulbar type, weakness of shoulders and arms is sometimes an early sign that impairment of the muscles of the chest (pectorals) and those of respiration (intercostals and diaphragm) may take place The nurse will be very watchful for signs of approaching respiratory embarrassment when caring for a patient with obvious involvement of the upper extremities

The patient may be asked to take a deep breath and begin counting If he is unable to count to ten without taking another breath some disturbance of the respiratory muscles has probably occurred and the physician should be notified immediately

Anxiety restlessness, and apprehension are also prodromal symptoms Attempted use of the auxiliary muscles of respiration, a jutting forward of the chin and prominence of the sternocleidomastoid muscles or of the platysma, dilatation of the nostrils on inspiration, and cyanosis are late signs The nurse should have detected and reported earlier symptoms before these occurred

The effect of spasm or tightness of the pectoral muscles on breathing should be understood by the nurse When in spasm the pectoral muscles become a tight inelastic mass clamped down on the rib cage in such fashion that little movement in the chest wall is possible Even though the intercostal muscles and the diaphragm are not involved, they may be unable to perform their normal functions in breathing because of the

Some review of the mechanics of respiration is necessary in order adequately to understand the operation of the respirator The respiratory function is accomplished by inspiration and expiration When the individual breathes in, the thoracic cavity enlarges by contraction of the muscles of inspiration—the diaphragm and intercostals The contraction of the intercostals lifts the rib cage, the contraction of the diaphragm depresses the floor of the chest, both thereby increasing the chest capacity

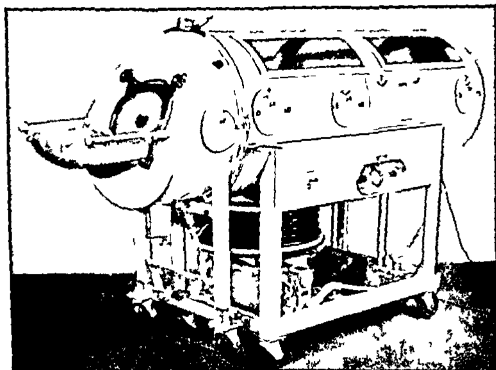


Fig 195 —Respirator modified for the care of the patient with tracheotomy (*Courtesy Warren E Collins Inc*)

This enlarged chest cavity returns to normal more or less passively—expiration is considered almost entirely passive by some physiologists It is due to the relaxing of the intercostals and diaphragm, as well as to the returning upward pressure of the abdominal walls now free from the pressure of the contracted diaphragm Where paralysis of the diaphragm and intercostals is present, all this is obviously impossible, and it is in these cases that the respirator has made its greatest contribution

With the patient's body in the airtight chamber of the respirator, but with the head outside, the respirator bellows, upon expansion, will cause the air pressure in the tank to become lower Since it is a physical fact

A great feeling of helplessness afflicts the nurse unfamiliar with the mechanism and technique of using the respirator. Furthermore, it is not enough that a nurse once learn these things. All the important details need frequent renewal in her mind to keep them in working order. Any nurse who is likely to be called upon to help in respirator emergencies should refresh her memory frequently by reading over the directions on the machine and by actually starting it, regulating its rate and rhythm, and altering its position. The private duty nurse would do well to be present, whenever she can, for demonstrations given to students and staff nurses in the hospital.

Care of the Respirator.—There is usually very little time to prepare the machine after the call comes that the respirator is needed. Upon its easy availability and expert working mechanism, the life of the patient may depend.

The respirator should be kept in a central location, one which is easily accessible to the elevator for quick moving. It should be made up with a small under sheet, a rubber sheet, and a draw sheet. It should be clean, the wheels oiled, the carriage well aired. The porthole cuffs and the collar of sponge rubber need frequent inspection to detect evidences of rotting, for there will be no time to replace these in an emergency. Usually the collar itself is not put on the machine until it is used, as there is less tendency toward rotting if the rubber is kept away from the metal headpiece. Furthermore, different sizes of collars will be needed according to the age of the patient for whom it is used.

Principles Underlying the Use of the Respirator.—Operating the respirator is in reality quite simple and, once the mechanism is understood, should cause no panic in any nurse. The reason that panic exists at these times, of course, is the speed with which the patient must be put into the respirator and the machine started to work. The spectacle of a patient cyanotic, gasping for breath—perhaps already breathless—is one that demands of the nurse firm self control and a pair of quick, unfaltering hands. It demands a calm, confident manner and expression, also the ability to keep the patient from being alarmed additionally by the panic of those around him.

Since each year finds newer, improved models of the respirator, no attempt will be made here to describe other than the actual nursing care of the patient. For assistance in operating the machine, the nurse is referred to the directions which are usually permanently attached and plainly visible on the machine itself.

Actual positive pressure is seldom ordered, and negative pressure some where between 14 and 18 is usually considered optimum Too great pressure in either direction is unsafe and may damage lung tissue considerably It is, furthermore, exceedingly unpleasant for the patient Hyperventilation of the lungs has been known to be the cause of pulmonary emphysema, as well as emphysema of a more superficial nature Alkalosis and tetany sometimes occur from this, and nurses should be prompt to report spasm of the wrists or feet, twitchings of face, legs, or thighs, these will be particularly significant if negative pressure in excess of 20 mm has been used over a considerable period in an attempt to overcome persistent cyanosis or other respiratory difficulty

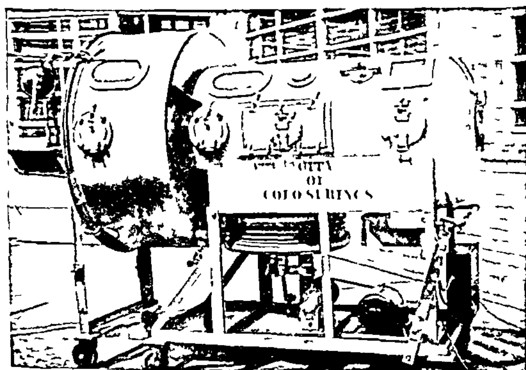


Fig 197 —Drinker respirator for orthopedic patients who require arm abduction as part of their treatment Note windows and ports at foot of machine which were added by hospital engineer Also note box for battery to supply electric alarm bell (From 'The Patient in the Respirator by Hulda Helling Some Suggestions for Nursing Care American Journal of Nursing)

Placing the Patient in the Respirator—Four or five people should assist in placing an adult patient in the respirator All of them should know what they are trying to accomplish in order to prevent clumsy handling of the patient The clamps at the front of the machine are unlocked, and the carriage rolled out The patient s body is placed on

that air pressures tend to equalize themselves, air from the outside will rush into the lungs by way of the nose and throat, expanding the lungs and thereby lessening the pressure in the chest, and equilibrium of air pressure will be restored The contracting bellows immediately increases

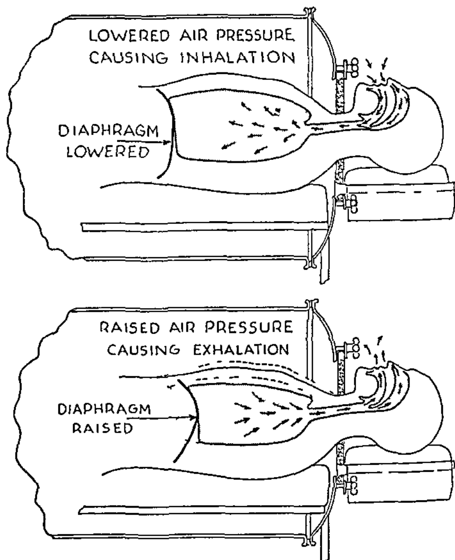


Fig 196—Diagrams illustrating mechanism of respirator (Courtesy Warren E Collins Inc From The Drinker Respirator by Mary E Norcross The American Journal of Nursing)

air pressure on the body in the tube, the chest cavity is compressed, and the patient exhales This constant rhythmical procedure aerates the lungs in the manner of natural respiration, but with no effort on the part of the patient

proceed to give the bath, working from either side The two lower ports are used by one nurse, the two upper ports by the other This enables the one near the foot of the machine to reach the bath basin more easily Each nurse assists the other in handing the equipment, soap, towels, and washcloth, back and forth inside the machine Considerable foresight is necessary in order to have everything in readiness before the actual bath is begun All equipment is first put in the machine through the large bedpan port



Fig 198 —Respirator with plastic dome *A* Dome open *B* Dome breathing for patient (Courtesy J H Emerson Company David Nilsson Photographer)

This method of bathing the patient necessitates much loss of pressure within the machine since four ports must be open during the bath This may be so great a source of discomfort to the patient that the machine must be set at higher negative pressure during the process Great care must be observed that this negative pressure is immediately decreased when the ports are closed

A second method, requiring only one nurse, is to have the bath basin on a stand drawn very close to the respirator ports The bath water is

the cot Two nurses should stand at the body end of the respirator, two at the head More may be needed in the case of a large adult The collar should be prepared as swiftly as possible This is best done by loosening the hand wheels which hold the collar at the opening, *one at a time* The outer edge of the collar at that point is then pulled out as far as it will go The wheel must be tightened at that point before the next wheel is unfastened This procedure, repeated on all four wheels, will give the maximum space for admitting the patient's head The two nurses at the head should insert their hands through this opening, spreading the collar still further if they can do so The nurses at the body end have the patient flat on his back, the head to one side chin lowered The nurses at the head grasp the patient's head with their hands and gently slide it through the opening, and, in order to protect the nose from injury, it is a good plan to have one nurse place her hand lengthwise over the nose at just the moment when the head is pulled through Pull the head through until the shoulders touch the end of the respirator The collar is then loosened by the hand wheels until it slips back well upon the patient's neck The screws are quickly tightened, the carriage is slipped into the machine, with the motor running Headrest and pillow can then be adjusted to the patient's comfort

The precaution of placing a small sandbag on the patient's abdomen to prevent quick involuntary swallowing of air when the machine begins to operate has been advised by some doctors If the patient is conscious he must be told to swallow on expiration The patient is often too frightened and sometimes too resistant to be of much help during the early minutes of his stay in the machine but when his breathing becomes regulated to the mechanism of the machine, he is usually much relieved If he has been greatly exhausted by a prolonged period of dyspnea, he will fall asleep, often so profoundly that sleep may simulate coma

The need for the respirator in the combination type of poliomyelitis —bulbar and spinal—has already been discussed When tracheotomy is done, some modification of the respirator equipment will be needed The jacket or vest type of respirator may prove sufficient in this case If not, the standard type of machine should be tilted headward, and, if possible, a conical collar should be provided to keep the operated area free from contact with the rubber

Nursing the Patient in the Respirator—Two methods for giving baths to patients in respirators have been evolved One is to place a small bath basin in the machine, either at the foot of the mattress, if the patient is small, or between his legs if he is an adult Two nurses then

As the orderly pulls the patient's body toward him gently, the nurse on the opposite side bathes and rubs the back Care should be observed that the patient's head is turned with the body, and this can be done if the orderly puts only one hand in the respirator as he turns the shoulders, using the hand outside the machine to turn the patient's head at the same time This method is especially recommended for long term respirator patients who have no respiratory power whatever and who cannot be out of the machine at all

The child in the machine presents no such problem as the adult, and, for that reason, discussion of care in the respirator will be viewed from the more difficult situation

Special linen for the respirator can be made of scrap pieces and no extra material is required Only a small amount of labor need be involved Sheets that are just big enough to cover the mattress are easier to manage than large sheets with so much surplus that tucking them in neatly is often impossible Draw sheets need to be very small, or excess material tucked in will be felt by the patient beneath the thin mattress

If the machine openings are lined with sponge rubber, considerable attention must be paid to the patient's skin around the neck Some provision for protecting the skin against the rubber should be made Chamois, cotton, old soft diapers can be used for the purpose Whatever material is used should be washable in order that it may be kept clean and fresh from perspiration It is advisable to shampoo the patient's head frequently, as this rubbing and stimulation seems to increase circulation and decrease likelihood of abrasions and pressure areas on the neck and upper back Generous powdering of the neck is also of value

Improvements have been made on standard respirators during the past few years which contribute greatly to the patient's comfort and to the ease with which nursing care may be administered Of particular interest is the addition of the "glass dome" which makes it possible for the tank of the respirator to be open for nursing and physical therapy A plastic dome, or "blister," surrounds the patient's head, and positive pressure, produced by the same mechanism which operates the respirator itself, is introduced intermittently to maintain the established respiratory pattern while the tank is open It is possible to have this mechanism attached to the older machines, but the machine must be sent to the factory for the alteration

It has been found that older type respirators can be definitely improved from the standpoint of ease in nursing care by the addition of new ports and windows An additional window and port in the foot

very hot, and the nurse uses a small washcloth which may be carried through the port easily One arm is kept inside the respirator at all times, while the other is brought out long enough to quickly rinse the cloth, wring it out and slip the hand and cloth back through the port The bath given in this manner takes longer, but it can be given by one nurse satisfactorily With the adult patient it is somewhat difficult for one nurse to manage if the basin is kept in the machine, since the normal

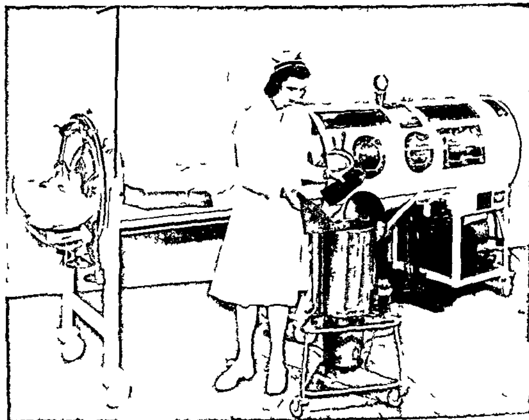


Fig 199—Hot pack machine and domed respirator (Courtesy J H Emerson Company)

arm length of the nurse makes it impossible for her to reach it while she is bathing the upper parts of the body Some loss of pressure is involved in this procedure also, but it is much less than occurs with the constant use of four ports The stand with the bath basin is moved to the opposite side of the machine when the nurse is ready to begin bathing the other side A rest for the patient between these two steps of the bath is essential For the back and change of linen, the assistance of another nurse or orderly will make it necessary to use four ports for a short time

be done, even on a large adult patient, in much less than two minutes if the members of the working crew know exactly the part they are to play One nurse should stand at the head of the machine and keep careful watch over the patient, as he is frequently unable to talk and inform the working crew that he needs to go back into the machine

It is urgent that *fluid intake* and output be recorded even on long term patients Renal calculosis occurs very frequently in this type of patient, and a considerable fluid intake is usually considered a prophylaxis Calcium phosphate is sometimes ordered for this also Change of position will do more than anything to prevent renal and other complications The machine should be rotated from side to side at stated intervals during the day to give as much change of position as possible

It is felt by many nurses that patients may safely be turned to the face lying position for short periods for back care and relief from the discomforts of constant back lying It is advisable to begin to do this early in the course of the patient's illness, before fear reactions have set in against any type of adjustment If the cot can be pulled out momentarily, the patient may be turned prone, care being taken that head, neck, and body are turned at exactly the same moment To turn the patient to the face lying position without opening the machine is a clumsy and hazardous proceeding because of the danger of twisting the patient's neck as the body is turned

Enemas can be given, either with the can on the outside of the machine with the tubing passed through the small opening for this purpose, or small enemas can be given by funnel and tube inside the machine Catheterization is difficult, but can be accomplished by the use of gloves, sterile gloves are used to cover the nurse's hands and are removed from inside the machine without contaminating the hands It is usually possible to remove a patient long enough from the respirator to perform this task quickly

It is indispensable that an alarm bell, on a separate battery, be attached to the machine, automatically controlled so that it rings loudly in case the motor of the machine should fail Special nurses are often not procurable for long term patients in the respirator, and to leave a helpless patient at the mercy of a machine is to add to his insecurity immeasurably

Respirator patients may be taken outside, onto sun decks, if the machine is provided with an extension cord long enough for this purpose In the hot weather, placing dampened sheets over the metal tube of the respirator makes the interior more bearable for the patient A glass

end of the machine are a great boon to the nurse caring for the adult patient's feet It is not a difficult process, and the hospital engineer will be able to accomplish it with but little assistance It does, however, involve moving the patient to another machine while the new window and port are being made With extra ports and windows toward the lower end of the machine, much greater attention can be given to the position of the patient's body Foot protection can be maintained by having specially constructed footboards made to fit in the respirator If these are not available, sandbags or small boxes may be used Outward rotation of thighs can be overcome by sandbags or rolled cotton blankets It is possible to put casts on patients in respirators if enough foot ports and windows are present in the machine

The rubber gasket which surrounds the opening of most respirators must be given special care One group of nurses, not informed of this danger, were confronted with a grave emergency when, having opened the machine for thirty seconds, the patient's maximum time without respiratory assistance, the gasket became loose and dislodged at one section of the opening No pressure, or very little pressure, is possible inside the machine when the gasket is loose Powdering the gasket daily helps to prevent suction and friction which shorten its life

The patient's arms should be carefully watched when the carriage is removed from the tube for a brief period In the rush of getting the carriage back, sometimes the arm is overlooked and may drop to the side A grave accident might occur from this situation

When the patient has advanced to the stage that he can be out of the respirator for two or three minutes, it is much easier to change the linen during this time Everything must be in readiness before the machine is shut off, and the crew should have specific instructions of just what function each is to perform All loose articles should be taken from the respirator before it is opened, to prevent pillows, sandbags, and the like from slipping down into the tube and jamming the machine The lower sheet can be fanfolded, either across or longitudinally, depending on the size of the patient For a very large or tall patient, the sheet is fanfolded in its short dimension and is tucked in first at the feet An orderly should lift the hips as the sheet is passed under them, and nurses or attendants on either side of the machine will be needed to tuck the sheet snugly under the shoulders—by far the most difficult part of the procedure If this is not done carefully, the patient is likely to suffer discomfort most of the day The small rubber drawsheet fanfolded with the linen drawsheet is then brought under the patient's hips This can

fore they are able to sleep Considerable skill and experience are necessary in handling this situation, and the nurse must be guided by the physician's advice before urging that the patient attempt to sleep out of the machine when he is manifestly unwilling to do so

The Rocking Bed —A new type of rocking bed has been used by some physicians to assist the patient in gaining independence from the machine The mechanism of this bed consists of a seesaw motion, and inhalation occurs more or less passively as the head is elevated and the



Fig 200—*The rocking bed may be used to promote early weaning of the* patient from the respirator Each day, or several times daily the patient is placed on the bed for increasingly longer periods The length of time tolerated is determined by the patient's facial expression pulse rate and color *Nursing activities* can be performed with the bed in motion Liquid or food is given when the head of the bed is highest During this phase the abdominal *viscera tend to move* downward favoring movement of the diaphragm and inhalation of air

abdominal viscera shifted downward Then, with the feet up and the head down, the viscera move upward against the diaphragm and assist in exhalation These oscillations are regulated so that they are at the rate of normal breathing However, no matter what method is used to wean the patient from the respirator, it is always extremely important to watch the patient carefully for signs of fatigue Even a mild degree

shelf above the patient's head makes it possible for the patient to have papers and books, face downward, above him Eyestrain is considerable, and, where possible, local volunteer groups might be asked to read to the patient at stated periods during the week Respirator patients like games and can play them aptly by stating what moves or cards they will play during the game They should be encouraged to have visitors and, if possible, should be in a part of the hospital where activity occurs It is not wise to keep a respirator patient in a private room away from other people

Masks are to be worn by those feeding and working over these patients Even a mild cold or sore throat could be a major catastrophe here

Weaning the Patient From the Respirator—It is now felt that early weaning from the respirator may be vital to the patient's ultimate recovery When the physician has decided that this may safely be attempted, nurses should do their utmost to promote the patient's gradual independence from the machine The problem will have to be approached differently with each patient, but a few suggestions may be of assistance for the nurse who has no previous experience in this matter

It has been found that some patients prefer to begin this weaning process by having the motor turned off for short periods several times during the day The machine is not opened during the first few times this is done, and the patient is never left alone during these periods His full cooperation is necessary if a block is not to be set up against the whole weaning process The patient will gradually extend this period of independence, sometimes reaching to several hours, before the carriage is removed from the machine With the carriage out of the machine the patient may suffer what he thinks of as a setback, because usually he will not be able to maintain his independence for as long a period as he did when the machine was closed Tolerance for this, however, can be built up rather quickly if continual encouragement and assurance is given The nurse must be prepared for unpredictable and apparently reasonless periods of panic in which the patient is totally unable to stay out of the machine for the accustomed time

Patients usually have their greatest difficulty in attempting to remain out of the respirator during the night Long after they have attained almost complete independence from the machine during the day, they are sometimes unable to sleep out of it, and they must be returned be

chest can be made for a pattern Whatever material is used for the chest covering, it is usually sealed onto the body with sponge rubber, the whole being secured with tape webbing straps and buckles Considerable attention must be paid to the skin which comes in contact with the sponge rubber, as it tends to break down easily Vacuum cleaner hose can be used to connect the jacket to a bellows The bellows of the large machine may be used, or a portable bellows can be purchased for a moderate sum It has been found that rather less pressure is needed for this type of respirator than for the large one



Fig 202 —The chest respirator is placed over the chest and held in place by straps which encircle the patient s body The rubber edges must fit snugly about the chest wall if the individual is to receive benefit from the respirator

CHRONIC POLIOMYELITIS

Poliomyelitis is said to have reached the chronic stage after the muscles have made their maximum recovery, usually from eighteen months to two years However, a great deal of the progress which has been made during the convalescent stage can be lost if careful medical and nursing supervision are not provided thereafter Weight bearing and other similar activities place considerable strain on muscles, and even patients who have had very minor involvement may develop unsuspected weaknesses at this time unless a close check is kept on their progress

of fatigue is undesirable, and the patient should be returned to the machine before he becomes excessively tired

It should be mentioned that, though the patient may have worked up an independence of an hour or two, this cannot be depended upon in an emergency, if the electric current fails, for instance, the patient's endurance may be less than two minutes, because it is complicated by a type of panic For this reason, every person on the service where respirators are used should understand completely the mechanism of the hand pump Hand pump drills are a very wise practice and should include every person on the floors who is assisting in the care of the patients

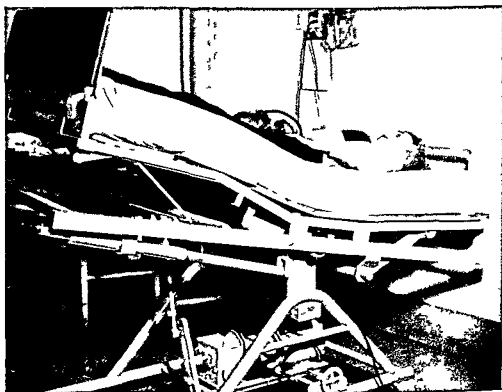


Fig 201 —As the head of the bed lowers the viscera shift upward against the diaphragm and air is exhaled At this time when air is going out through the larynx it is easier for the patient to speak The patient learns to inhale as the head of the bed rises and exhale as the head of the bed lowers

The Chest Respirator —Hospital manufactured chest respirators, as well as the commercial appliances are coming into general use at present It is always a challenge to a hospital engineer to provide some piece of apparatus to enable the long term respirator patient a chance to be out of the "iron lung part of the day A plaster mold of the patient's

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This fact is perhaps not clearly realized at present, since many individuals have read so much about new types of treatment that they tend to believe that any progress they have made is irreversible in nature

Emotional Aspects of the Disease —The treatment of poliomyelitis in the early weeks is dramatic enough that the full import of the patient's disability does not always become apparent to him for some time afterward Progress during the first weeks tends to be more rapid than it will be after six months' time has elapsed A gradual awareness of the permanent nature of his handicap may in some instances, particularly with the adolescent and the young adult, be the cause of major depressions and personality changes Indifference or apathy or self pity may replace the patient's original attitude of hope and courage and determination to get well His faith in the physician's handling of his case may be impaired to such an extent that he may decide to withdraw from it and turn himself over to the more glowing promises of the pseudo practitioner

The nurse should be forewarned that these things are likely to happen, that this is a rough spot over which she must be expected to guide the patient with considerable permanent involvement She should be able to warn parents and relatives that such an occurrence is a natural enough reaction To limit this period, to cut it down to its minimum by sympathetic, intelligent advice, should be part of the nurse's skill

Management of these situations demands early recognition of their likelihood While the nurse's attitude like that of the patient s must be based on faith and optimism, statements made must be guarded The patient should very gradually be brought to accept his handicap from the first days of his paralysis, to plan his life in terms of it, rather than in terms of complete functional recovery This is the only honest course for any of his associates to take It is kinder than unguarded optimism and cheeriness which break down under the strain of long deferred hope It goes without saying that such principles of mental hygiene as the nurse herself applies in her relationship to her work with the patient must be given to the family of the patient to guide them in their understanding of the patient's problems That this takes ingenuity is an understatement The nurse may be instrumental in helping the parents to plan in relation to the patient s homecoming such alterations of environment and living as will make self dependence possible for him The importance of friendship and relationship with young people of his own age must be

pointed out, so that the parents may make special efforts to see that such friendships as he enjoyed in school are continued while he is home bound

The patient's problem is a very real one Faced in the cold light of day and robbed of the mitigating factors which attend the early illness with its dramatic fight for survival, the outlook may be very black indeed It is a situation the newly crippled individual realizes, however dimly, that he has to face alone The pattern of his life is smashed He must re collect the fragments and make what he can of them, and the task may look hopeless, the effort not worth the while

It is impossible to lay down a schedule of treatment for this situation To meet it adequately the nurse's preparation must be broader than she herself perhaps realizes Besides her courses in orthopedics, sociology, community health, and mental hygiene, all of which should have perfected her ability to some degree in this regard, she needs a deep seated interest in people and their problems She needs to know what community resources for education and rehabilitation may be available to help this individual He will not know of them—three months ago he was a healthy person, with no knowledge or need of such services If ever there was an urgent necessity for broad information on these points it is at this time, when she earnestly accepts the challenge to assist a young newly crippled individual attacked by all the forces of pessimism and personal disintegration

The student should know the ways in which the physical therapist and the occupational therapist keep the patient interested in making further effort toward physical reclamation They must do this day after day in their work There is more skill in this than the student will realize unless it is occasionally pointed out to her Facile encouragement, more or less mechanical, will not accomplish much The patient soon learns to detect patent signs of insincerity in the nurse

Nurses can do a great deal in the way of providing diversional activity for these young people in the hospital if they will try to remember the things they liked to do at that age, and find some means of encouraging the patients to develop like interests In order to encourage hobbies in her patients, the nurses should have a few of her own which she may offer to explain to the patient Many nurses initiate such hobbies by contributions of their own Stamp collecting, postmark collecting, and match folder collecting are cheap and interesting and might provide a beginning for a "pack rat" career

Where it is possible, a ward governing body may be developed Such groups can have more functions than might be apparent at the outset, and they often do much to improve ward spirit and morale Complaints, requests, plans for activities and parties, welcoming committees for new patients are functions which can be worked out of the original self governing group Great pride in this matter has been observed in wards where such a democratic system of ward regulations is carried out over a period of time

General Health Supervision —Nurses who supervise the care of patients after poliomyelitis should aim to assist their patients in the daily requirements of living in the home, such as bathing, dressing, getting out of a chair going to the toilet and other similar activities It will often take considerable planning and ingenuity to make it possible for the severely involved patient to do some of these things, but certainly no service can be more important To achieve these ends, adaptation in home equipment may often be necessary Nurses will frequently be able to secure help and advice from members of the family who have an aptitude for mechanical construction and carpentry Consultation with a physical therapist or an occupational therapist will often give the nurse valuable hints she needs for attaining some of her objectives

Frequent inspection should be made during the period when functional activity is being resumed in order to detect habitual faulty positions in sitting walking, or standing The public health nurse should be on the alert for incompletely extended hips, for tendencies to stand in the back knee position, and for deviation of the spine due to poor habits of sitting and standing She should observe unequal growth of the legs or feet, which might indicate overuse of one extremity due to a disguised weakness in the other The parents should be instructed to observe signs that the unaffected parts of the patient's body are becoming weakened due to overuse and fatigue No matter how mild the involvement from poliomyelitis, patients must be taught to avoid fatigue for a long time after their recovery Periods of rather strenuous activity will often reveal weaknesses in muscles which were never originally thought to be involved Periods of bed rest should always follow periods of prolonged or strenuous activity The afterlunch nap of an hour should be part of the patient's daily program It should be taken in a darkened, ventilated room, free from the distraction of radio or toys

The child with only a short leg brace or splint often tends to sit or lie for long periods with the leg rolled outward due to the weight of the

apparatus The mother's attention should be called to this position, which is often the cause of troublesome deformity at the hip level when the child begins to walk

The danger of eyestrain should be borne in mind, particularly in the older patient, who spends so much of his time reading or doing hand work requiring close attention Attitudes denoting eyestrain, squinting, frequent headaches, reddened lids, holding the work too close to the eye, should be reported to the physician, since glasses can probably relieve much of this strain

The child's eating habits should have close attention He needs vegetables and milk He should not be allowed to make excuses in his eating Because of relative inactivity combined with normal appetite, these patients tend to gain weight easily The diet may have to be limited sensibly, *but it should not be limited in essential features for a growing individual* Parents need instruction in this matter or they will not realize that plenty of good food does not particularly mean whipped cream, pork chops, and desserts in abundance The child s functional disability will be greatly exaggerated by a substantial gain in weight, and weakened muscles will undergo further strain from having to support it

Constipation may become a chronic problem, particularly if the patient has had too many cathartics early in the course of the disease Regularity by habit should be maintained with these children as far as possible Though standing orders for cathartics usually exist on orthopedic divisions, it is well for the nurse to seek advice from the physician for persistent constipation in these children rather than to administer cathartics routinely

In a ward full of crippled children it is easy for the nurse to lose her individual approach and, in the pressure of work and responsibility, to "keep at' the child about position, attitudes, habits, and the like until he becomes surly and disobedient at the slightest provocation This is mismanagement in its way as serious as the mismanagement of muscles Consideration of the patient as an individual is necessary, and his individual problem, which is bound to be a little different from that of the child in the next bed, must be given consideration If he seems unruly and twists and turns in bed despite all of your pleas, perhaps you can arrange his bed so that he may see different parts of the ward at different times of the day

On the whole, younger children tend to adjust to their condition much more easily than older ones, which is not difficult to understand

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The use of cotton shirts beneath these jackets is essential both for the patient's comfort and for the cleanliness and long life of the brace Oiling of the skin tends to stain leather portions of the braces, and these stains are very difficult to remove Where incontinence is present, some times the upper portion of the leather thigh cuff may be protected with waterproofing Though desirable, it is not always possible to get the bulky diapers and rubber pants beneath the brace, and these have to be applied outside, leaving the leather portions near the groin exposed to frequent wetting

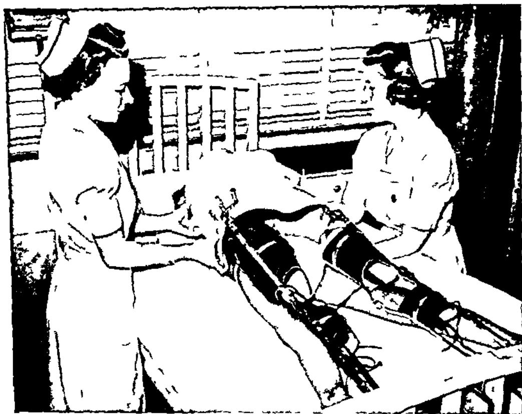


Fig 203—Application of body and leg braces to patient with poliomyelitis Patient lies prone until the leather corset is placed around trunk and then is gently turned and legs are fitted into the leg braces Note automatic locks at knee and hip above hinges These may be slipped upward and hinges will then allow the brace to bend as joint flexes

All straps on braces should be securely fastened, but care should be taken as the child takes on weight or grows that constriction of circula tion does not take place through this means Nurses new to orthopedic services will need instruction in the application of each of the more complicated types of braces—particularly the corrective scoliosis braces,

The older patient will be affected by periodic spells of gloom and depression, accompanied in some cases by definite refusal of cooperation These patients need some definite assurance of advancement It is the long period of confinement, the inactivity, the limitation of body motion that bring on these periodic spells of depression

BRACES

Application of Braces —When braces are ordered, a considerable outlay of expense is involved A respect for the cost and skilled labor going into these braces is a healthy virtue for the nurse to develop in the patient Their care is part of the teaching the student does for the family Knowledge of their purpose, the correct way of applying them, recognition of the purpose of each part, and the necessity for keeping them *intact are essential*

Nurses may encounter some resistance to the use of braces at the present time This is due in large part to the unwise publicity given to the dispensability of braces in certain "systems" of treatment Many individuals honestly believe that to walk in any manner, however hazardously, without braces, is preferable to walking with them The patient who has a strong dislike of braces can rationalize his determination not to wear them by resource to many arguments he has read in the press against their use, and nurses will need to be rather well informed about the reason for the prescribed braces in order to present the case for them intelligently

Braces are frequently necessary to permit the patient to walk without undue strain or fatigue They are also used to prevent or overcome mild deformity or tendencies toward deformity The ultimate purpose of orthopedic surgery is to restore the patient to normal living Braces are only a step in this direction The ultimate aim is, if possible, to eliminate the use of braces either by further development of the patient's own remaining powers or through some type of reconstructive surgery

Braces should be applied with the patient lying in good position in the bed Prone lying is recommended for the application of the combined body and leg brace, frequently used in chronic poliomyelitis Pelvic bands should fit just below iliac crests The trunk part of the brace must be observed to be sure that fastening is in the midline of the body—any minute variation of this will make the fitting of the entire apparatus faulty

Braces may have different kinds of locks at the knee The most common is known as the sleeve lock This lock slides up and down over the hinge, releasing it or holding it fixed in the position of extension The automatic lock is one that the patient must learn to operate When ready to sit, the spring which controls this lock is released by pressure on the seat of the chair The patient is then able to bend the knee

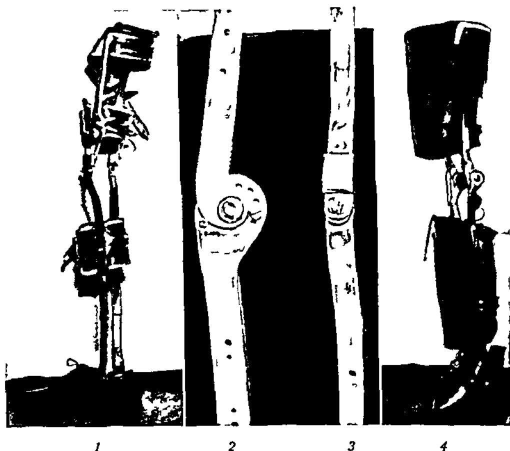


Fig 204 —*1* Long leg caliper brace with an automatic knee lock *2* Set or fixed lock *3* Sleeve lock *4* Long leg brace with footplate and no knee lock

Care of Braces —All joints and locks on the braces should be oiled weekly with 3 in 1 oil, or a similar lubricant, and surplus oil immediately removed so that it does not stain the surrounding leather Lint should be removed from screws before they are oiled Saddle soap and small amounts of water cleanse leather parts satisfactorily, although cleaning fluid such as benzine may be used Leather should be polished after the use of saddle soap as this both refurbishes and imparts a certain amount of water resistance to the leather

the different types of clubfoot braces, and the Taylor spine brace Auto matic locks should be explained and their use demonstrated The stu dent deserves to have this instruction from her head nurse rather than from the patient, from whom she too often gets poor instruction

Lacings or shoestrings used on braces should be kept in good con dition, without knots, and they should be changed as they become frayed If the tips fall off, new ones can sometimes be constructed with the aid of collodion applied in successive layers Frayed straps should be reported to the doctor or brace maker if he is available Felt padding or metal bars may be cleaned with cleansing fluid, ether or benzine

If arm splints are used, they should be inspected frequently to see if the splint is actually maintaining the arm in the position desired Pa tients wearing arm splints have a tendency to lift the shoulder by con tracting the strong upper trapezius muscle, thereby robbing the upper arm of the support of the splint It may be necessary to take a little time to instruct the patient how to relax the trapezius muscle in order that the arm may rest in the splint as prescribed If weakened shoulder or back muscles are present and no splint is worn, nurses should ob serve if the weight of the arm seems to pull the shoulders downward in undesirable postural attitudes Some provision to eliminate this pull may need to be devised If the patient is bedfast, canvas hammocks may be suspended from an overhead bar which will support the arms and prevent the pull on weakened shoulder muscles If the patient spends considerable time sitting, the arms may be supported by armrests constructed of pillows, pads, or boxes, which may be placed on the desk or table top or on the arms of the chair It is sometimes possible to im provise an upright support with an overhead bar to a wheel chair Hammocks or cuffs may be suspended to this bar to support the hands and arms for part of the day It is usually permissible for the patient to use his hand and elbow functionally in eating, writing, or holding a paper, if there is no involvement in these areas even though weakness is present in the shoulder muscles Too constant use of the forearm, however, may put more strain than is desirable on the shoulder, and frequent periods of rest from activity are advisable

Long leg braces may be of the caliper type, fitting into the patient's shoe With this brace it is especially important that the shoe be well fitting and of a type proper to good functioning of the foot Another type of long leg brace is made with a footplate which is worn inside the shoe The shoe must be wider to accommodate the footplate

Surgery for stabilization of the joints may frequently be done to permit the patient to walk without braces or crutches, and, even though it may accomplish this satisfactorily, some disappointment is often felt by the patient or his parents because the cosmetic effect has not been all that they had expected it to be Time should always be taken before surgery to explain all the factors involved in the surgery and its probable outcome in order that disappointment may be avoided Stories in newspapers and magazines during the past years have spoken so lavishly of 'miracle surgery" that many individuals expect an almost impossible result from orthopedic surgery and are disappointed when the outcome falls a little short of what they have expected

The immediate aftercare is that given to any orthopedic surgical patient, and it is an extremely important factor in the eventual outcome Since most operations done on poliomyelitis patients fall under the classification of *clean* surgery, the greatest care should be taken to eliminate the chance of wound infection during dressings Casts or other immobilizing apparatus must receive continued intelligent care both in the hospital and at home in order to accomplish the purpose for which they are intended Since a great deal of the ultimate success of muscle transplants will depend upon prolonged and skillful physical therapy treatments, nurses should make every effort to see that follow up treatments are continued until the maximum recovery of function has been obtained

NERVE CRUSHING

Nurses will read articles from time to time having to do with nerve traumatization in the treatment of poliomyelitis This procedure is sometimes known as the Billig van Harreveld treatment The peripheral nerve is crushed above the point of muscular atrophy in an extremity paralyzed or weakened by poliomyelitis The success of the procedure is predicated on the possibility that the nerve fibers which have been traumatized will send out branches during the regeneration of repair, thus producing a greater nerve supply for the muscles of the weakened extremity This treatment is done, of course, only on patients in the late convalescent or chronic period

Missing parts (screws, laces, hooks, straps, pads, or felt lining) should be reported as soon as noticed The patient will learn respect for his apparatus by the nurse's prompt attention to such details The shoes attached to his braces, usually by caliper through the heel, must be inspected frequently for signs of wear and abnormal pressure Children of growing years tend to outgrow shoes and braces with alarming rapidity Points to be recognized as indications that the child is outgrowing the braces or shoes must be called to the attention of the parents when correct application is demonstrated to them

If elastic straps are attached to braces or shoes, inspection of the brace should include examination of this elastic for its resilience These straps may go from the sole of the shoe to a point just below the knee, to form a sort of external dorsiflexor in case of drop foot due to paralysis of the anterior tibial muscle Elastic is also used in many types of scoliosis braces

Inspection of the skin when the brace is removed may reveal bruises discolorations, skin abrasions, or dermatitis Any deviation from the normal condition of skin or underlying tissues should be reported, for suitable alterations can usually be made to overcome such friction

Knee pads worn over the anterior aspect of the knee should tell the nurse of strong hamstring or flexor muscles around the joint, combined with relatively weaker extensor muscles Such pads are placed in front of the knee to prevent the child s feeling of insecurity and fear of jack knifing as he walks A similar pad on the posterior aspect should tell her of strong quadriceps extensor muscles, which tend to pull the knee into a hyperextended position (genu recurvatum) Frequently these knee pads get lost because the nurse and patient do not recognize them as an essential part of the brace

The nurse in all her teaching of parents and relatives must constantly emphasize the necessity of periodic checkups for all patients wearing apparatus of this nature

NURSING CARE AFTER SURGERY IN POLIOMYELITIS

As has been stated in the preceding chapter, surgery may be done following poliomyelitis to correct deformities, to secure stability of the joints, and to improve function Since some surgery is made necessary because of neglect in early treatment or because of carelessness in following instructions given for home treatment, nurses should be very earnest in their attempts to see that instructions for home care are followed to the letter

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QUESTIONS FOR STUDY—UNIT VIII

1 Discuss community organization for meeting an epidemic of poliomyelitis

2 Describe the early symptoms of poliomyelitis

3 What are some of the common findings in the spinal fluid of a patient with early poliomyelitis?

4 What can a nurse do to allay the panic that often arises in a community threatened with an epidemic of poliomyelitis?

5 Discuss some of the problems of the patient with residual paralysis following poliomyelitis

6 What are the symptoms of bulbar involvement in poliomyelitis?

7 Describe desirable bed positions for the poliomyelitis patient with involvement of the lower extremities with involvement of the upper extremities

8 What position would be most comfortable for the patient with spasm of the gastrocnemius muscle? With spasm of the hamstring muscles?

Unit IX
CEREBRAL PALSY

Chapter 20
CEREBRAL PALSY

DEFINITION

Cerebral palsy is the term applied to those conditions which are characterized by impaired functional muscular control as a result of abnormality in cerebral areas which effect neuromuscular functions Spasticity is a type of cerebral palsy, although frequently the terms are used erroneously in a synonymous manner

PREDISPOSING FACTORS

Certain factors which are essentially uncontrollable increase the likelihood of a child having cerebral palsy during the period immediately surrounding birth

1 First born —This factor applies until the mother's fourth or fifth pregnancy occurs Thereafter, there is an increasing likelihood that later children may suffer the disorder However, the incidence in subsequent children is not as great as in the first born

2 Premature Birth —Approximately 40 per cent of all cerebral palsied individuals have a history of prematurity As might be expected in premature infants, the greater the prematurity the greater is the likelihood of brain damage

3 Abnormalities of Labor —A prolonged period of labor or an unusually rapid labor is more likely to produce cerebral palsy

4 Abnormalities of Delivery —Unusual fetal presentation, major manipulative procedures, or cesarean section is more prone to be productive of the disorder

5 Multiple Births —One of twins, usually the second one delivered, has a greater likelihood of being afflicted than if the product of conception has terminated in a single birth

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follows depressing maternal anesthesia which in turn temporarily enfeebles the vital centers of the baby, thus delaying the onset and effectiveness of natural respirations, placenta praevia or abruptio, thus removing a source of oxygen to the baby before the infant's normal respiratory mechanism can operate, delaying birth unduly by force against the presenting part pending the accomplishment of desired preparations for delivery, prolapsed cord with delay in delivery of the head, difficult instrumental delivery acute hypotension in the mother due to spinal anesthesia, precipitate birth resulting in cerebral damage as a result of sudden change in pressure from intrauterine to extrauterine life, breech presentation with delay in delivery of the aftercoming head, and vigorous manipulative procedures

3 Postnatal Conditions —Most of the situations occurring after birth which may lead to brain abnormality are more apparent The more important of these circumstances include the following kernicterus, often the result of erythroblastosis, brain infections, such as meningitis, encephalitis, and abscesses, cerebral trauma, often resulting from falls or other accidents, intense or prolonged anoxia resulting from any cause, brain tumors, and cerebral circulatory anomalies, often leading to rupture

Certain systemic diseases may cause brain damage as a result of secondary effects For example, (1) cerebral thrombosis may be a complication of nephritis, nephrosis, or other disease, (2) cerebral embolus may result from subacute bacterial endocarditis occurring as a complication of rheumatic fever, congenital heart disease, or other condition, and (3) rupture of minute cerebral blood vessels may occur with severe paroxysms of coughing in one with pertussis

CLASSIFICATION

The most useful classification at this time is one based on clinical findings There has been insufficient autopsy material correlated with careful clinical observations in the same individual to permit an authentic pathological categorization according to types

a Table I lists the basic *clinical types* in decreasing order of frequency of occurrence as recognized by most physicians who are particularly interested in cerebral palsied patients

A mixture of more than one type may be present in the same individual but probably is not found in more than approximately 1 per cent of all patients

6 **Heavy Birth Weight**—Babies with heavier than average birth weights are more likely to suffer brain damage This apparently is due to increased probabilities of cerebral trauma resulting from increased head size

7 **Race**—Cerebral palsy reportedly is somewhat more common in Caucasians than in dark skinned races

8 **Sex**—Males are slightly more prone to be afflicted than females, although a great difference does not exist

INCIDENCE

Phelps has reported the frequency to be 7 cerebral palsied babies for each 100,000 general population per year as the result of prenatal or natal causes Morbidity figures according to live births vary among observers from 1 200 to 1 568 The total number of cerebral palsied patients of all ages has been estimated to be between 400 and 600 per 100,000 general population

CAUSE

Conditions which produce (a) cerebral anoxia, (b) hemorrhage or trauma, either singly or combined, are the most common etiological agents These factors may operate during the prenatal, natal, or post natal periods of life and produce irreversible brain abnormality resulting in cerebral palsy if of sufficient intensity or duration

1 **Prenatal Conditions**—The more common of these include infectious illnesses in the mother early in pregnancy, particularly mild viral infections, abnormal placental attachments, toxemia in the mother, maternal hypotension anemia radiation, particularly early in gestation and if therapy is directed to the mother's pelvic organs, iso immunization, such as Rh incompatibility between mother and fetus, and any condition in which the mother suffers intense or prolonged anoxia The hereditary element per se is a very uncommon cause for cerebral palsy Recent investigations have suggested that maternal nutritional deficits preceding and during pregnancy may bear an important relationship to the presence of brain abnormality and cerebral palsy in the human offspring

2 **Natal Conditions**—The natal period refers to that period of pregnancy from the onset of labor to the birth of a viable child Incidents which may produce brain damage during this time are primarily those of anoxia and trauma, either singly or combined Some of the more common situations producing these damaging cerebral onslaughts are as

The high spinal spastic type has been described in addition to those types as presented in Table I The site of damage in this is at the level of the juncture between skull and atlas The manifestation expected with this lesion is spasticity of the lower extremities

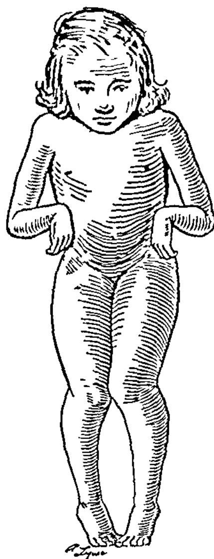


Fig 207 —Cerebral palsy with spastic quadriplegia Flexion at all joints except the ankles Adduction and internal rotation of the thighs Scissors gait

b The *extent* of involvement is variable from patient to patient Table II indicates the descriptive terms used to denote parts of the body involved

c The *degree* of involvement is perhaps more important when considering possibilities for physical rehabilitation than is the type of cerebral

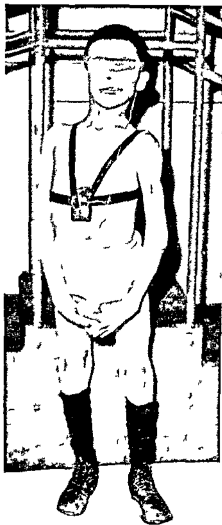


Fig 205



Fig 206

Fig 205—Twelve year old boy who has (tension) athetosis and associated hearing loss partially compensated by hearing aid Note generalized hypertrophy of muscles more involvement of right shoulder than left pronated feet and voluntary attempt to stabilize purposeless movements of the right upper extremity by clasping with the left hand

Fig 206—Lateral view of same boy showing marked lordosis and genu recurvatum as a result of increased tension in attempt to maintain standing balance as his center of gravity shifts

TABLE III

ASSOCIATED DEFECTS FREQUENTLY PRESENT IN CEREBRAL PALSIED INDIVIDUALS

DEFECT	APPROXIMATE FREQUENCY OF OCCURRENCE
Mental defectiveness	25 to 40 per cent
Educational retardation	Frequency is correlated with degree of severity Very common in patients other than mildly involved
Speech involvement	70 to 80 per cent
Hearing defects	30 to 40 per cent
Oculomotor abnormality	30 to 40 per cent
Convulsive disorder	40 per cent
Perceptual defects	Frequency undetermined More common in athetoids
Symbolic language disability*	Frequency undetermined Probably fairly common
Physical growth retardation	Frequency is often related to the degree and extent of involvement In part due to feeding difficulties
Emotional disturbances	Fairly common to varying degree

*Includes dysphasia aphasia reading disabilities and allied abnormalities

SOCIAL INFLUENCES

Very few diseases have social factors complicating the condition as extensively as does cerebral palsy Formerly it was considered that all cerebral palsied individuals were feebleminded, thus institutional placement was the course to follow Unfortunately, this attitude still exists in the minds of a segment of the population and it has been conducive to the social isolation of afflicted individuals in their homes In addition, many other factors currently exist to the detriment of a healthful emotional state in one with cerebral palsy Some of these are enumerated as follows

1 Parental Guilt Feelings and Martyr Complex —Studies have indicated that over two thirds of all parents with cerebral palsied children (a) have feelings of personal guilt and (b) consider that this handicapped child is theirs as ' a cross to bear " One would expect that such attitudes might be conveyed readily by the parent to the child in ways other than verbal expression Parents who have these feelings to a strong degree are loathe to discuss their problems with others and tend toward voluntary (a) introversion or (b) extroversion and oversolicitousness as a compensatory device

2 Family Disagreements —Approximately one half the parents of cerebral palsied children in one study admit to serious family disagreements regarding problems presented by their cerebral palsied children

3 Parental Lack of Information —The majority of parents have little or no authentic knowledge of etiological factors, possibilities for successful rehabilitation, realistic aims, or even a basic understanding of

TABLE I

BASIC CLINICAL TYPES AND CHARACTERISTICS IN CEREBRAL PALSY

TYPE	BASIC CLINICAL CHARACTERISTICS
1 Spasticity	Increased resistance to manipulation stretch reflex hyperactive deep tendon reflexes clonus tendency to contracture deformities lower extremities often more involved than uppers
2 Athetosis	Involuntary and incoordinated motions without conscious control normal reflexes when in relaxed state upper extremities often more involved than lowers
3 Ataxia	Disturbance of autonomic balance nystagmus adiadochokinesis difficulty in concentrating vision on a fixed field normal tendon reflexes
4 Rigidity	Lead pipe resiliency of involved member tendency to maintain position of extension absent stretch reflex near normal tendon reflexes
5 Tremor	*Intention* tremor contractions occur only with attempted motions *nonintention* tremor contractions are present constantly no hyperactivity of tendon reflexes

palsy A *mild* degree of involvement suggests that extensive treatment measures are not necessary and can usually be accomplished by the parents in their home One who is involved to a *moderate* degree needs special therapy measures which often include the use of braces and sometimes surgical procedures One with a *severe* degree of involvement has only limited possibilities for physical rehabilitation even with the use of all special therapeutic measures available

TABLE II

EXTENT OF INVOLVEMENT

DESCRIPTIVE TERM	EXTENT OF INVOLVEMENT
Quadriplegia or tetraplegia	All four limbs
Hemiplegia	One side of body
Triplegia	Hemiplegia plus one limb of opposite side
Diplegia	Like parts on each side of body
Paraplegia	Both legs
Monoplegia	A single limb or part of body

ASSOCIATED DEFECTS

The presence of one or more associated disabilities in the cerebral palsied individual is more often present than not These disabilities are usually the direct result of the primary brain abnormality Table III enumerates the associated defects which are found more commonly in the cerebral palsy population

The broad aims of therapy should be (1) to establish locomotion, communication, and self help, (2) to work toward an appearance of normality in all motor functions, (3) to correct associated defects as effectively as possible, and (4) to provide educational opportunities adapted to the given child's needs

This plan of therapy may be accomplished in the home, in a hospital, or it may require special and prolonged facilities as provided in a hospital school In any eventuality, continued home therapy becomes essential for those patients who may have had their therapy initiated in a hospital or hospital school The needs of the patient and the home facilities available become most important in deciding which of these facilities is most advantageous for a given patient

Obviously, to enable one to establish more specific aims in therapy, a thorough evaluation of the entire person becomes a necessity at the beginning of his management and must be effected recurrently as his needs demand Usually the scope of this evaluation goes beyond the capabilities of a single person and often requires the services of a physician, psychologist, speech pathologist, social worker, nursing personnel, and other professional persons

1 The services of *special therapists* in physical therapy, occupational therapy, and speech pathology frequently are necessary to accomplish corrective exercises in a given patient or to instruct and demonstrate to parents sufficiently so that recommended procedures may be accomplished in the home Parents can accomplish many of these exercises if they are instructed adequately in measures to be accomplished

2 *Medical help* is required in several ways Of importance is one physician who may act as a coordinator of the rehabilitation program for a given patient because of his particular interest in this condition He may be a general practitioner or specialist in any one field It is he to whom the parents may turn for counseling when questions arise The consultation of other medical specialists frequently is necessary for purposes of correcting associated defects as well as aiding in the basic rehabilitation program

3 *Appliances* such as braces or splints are used frequently for purposes of (a) correcting or preventing deformities, (b) reducing incoordinated and purposeless movements of the limbs, or (c) affording increased stability

4 *Special equipment* often becomes necessary as a means of effecting therapy procedures Kneeling benches, stand up tables, parallel bars, relaxation chairs, and special adaptations of feeding utensils are most commonly used

what the term cerebral palsy means Perhaps, as might be expected, the majority of parents overrate both the severity of involvement and the mental acuity of their cerebral palsied child due to lack of knowledge or failure to accept the facts Approximately one half the parents of cerebral palsied children make little or no use of literature available on the subject, and most of those who have attempted self education in this manner have found their reading to be confusing or of no help It is not unusual to find parents who are accomplishing no rehabilitation program at home because they are uninformed as to how they should proceed

4 Professional Help Sought —The common response of parents of cerebral palsied children is (a) rejecting the initial examiner and the information he gives when it is unfavorable, (b) seeking more favorable information from other sources, and, finally, (c) accepting the child's condition realistically Thus, in one study of 200 consecutive parents of cerebral palsied children with an average age near eight years, the average amount of help sought per child was from nine medical physicians, two chiropractors and one osteopath Obviously, such shifting parental allegiance is detrimental to the possibility of any helpful approach to the child

5 Oversolicitousness —Approximately 40 per cent of these parents admit to oversolicitousness toward their child Experience suggests that this is a conservative estimate School teachers, playmates, and other associates of the cerebral palsied are prone to manifest this same attitude and thus enhance the impact of this factor

6 Limitations in Socialization —Socialization experiences of the handicapped child are usually curtailed proportionately according to the severity of his physical handicap or associated defects Approximately three fourths of all cerebral palsied children who are not in school have few if any playmates outside their home In addition, it is not uncommon to find a cerebral palsied child of five or six years of age who has never been inside a super market or "five and ten cent" store seen an airport, or had similar experiences which are fairly commonplace for a nonhandicapped child

THERAPY

An effective therapeutic program may require the services of an organized group of professional people in view of (a) the physical handicap itself, (b) the associated defects some of which are usually present in one with cerebral palsy, as mentioned previously, and (c) the social influences encountered by the cerebral palsied child

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Chapter 21

NURSING CARE OF PATIENTS WITH CEREBRAL PALSY

Cerebral palsy is outranked only by poliomyelitis as a cause of crippling in children Yet it is not unusual for student nurses to complete their entire course of training without caring for such a patient on the hospital wards Indeed, nurses often tell their instructors that their most impressive introduction to the patient with cerebral palsy is frequently outside the hospital entirely, on the street or in the home of some friend or neighbor

Infantile paralysis has received much attention during the past decade, and much has been done to aid the sufferer with this condition One could hope that a similar amount of public interest might be evinced by this other comparable problem However, cerebral palsy is a disability that does not strike spectacularly in epidemic form as does poliomyelitis, and the results of it, while quite as disastrous, are sometimes not as appealingly dramatic People are not instinctively drawn toward the unfortunate victim of this condition—they tend to be somewhat appalled and repelled by him, even when their sympathy for him is most manifest Each nurse, as an individual in her own private world, may sometimes make the lot of the cerebral palsied a more bearable one because she has been able to interpret his situation sensibly and realistically to her friends or to her community It can be admitted truthfully at the outset that this service may be a more important one than the relatively small amount of nursing care she will have the opportunity to give these patients in the hospital

In ward classes, student nurses discussing this condition frequently make very graphic by their own reports of past experience the opinions of the public at large One student told how, as a child, she would cross the street to keep from passing a certain young boy He jerked and twisted in all directions, and she was frightened of him—furthermore she had overheard some neighbors make the statement that his mother was frightened by a snake before he was born and that this accounted for his wiggling motions! She knows now that the boy was an athetoid and she remembers that he always seemed to try to smile in a friendly fashion at the people who passed him Another student told of a girl friend of

5 *Surgical procedures* on tendons, nerves, or joints become necessary in a certain number of these patients Neurosurgery has afforded very limited benefits thus far and is seldom used therapeutically

6 *Medications* have extremely limited usefulness Some products are of limited value for their relaxant properties, however, they are only adjuncts to other forms of therapy Some medications are used to reduce salivary action and drooling Preparations advocated earlier for improving mental acuity have since been found to have such limited value that they are unimportant The drugs ordinarily used for control of seizures have similar usefulness in the cerebral palsied

7 *Parent counseling* is of great importance in making a program of therapy effective The parent must be given (a) basic information regarding cerebral palsy in general and (b) facts pertaining to the condition as it relates to his own child Realistic planning for rehabilitation (both physical and educational) and eventually for vocational anticipations should be accomplished The counselor may be the physician who is coordinating the program or some other professional person if he has (a) competent knowledge, (b) adequate interest, and (c) sufficient adeptness

CONCLUSION

A person who has cerebral palsy is likely to have numerous and variable problems related directly or indirectly to his condition (a) Early recognition and attention to his problems, (b) intelligent planning and accomplishment of a coordinated program of rehabilitation, and (c) wise counseling are measures whereby satisfactory restoration may be effected in the majority of those so afflicted

such as being unable to sit up or to lift the head, and the story is told that the baby was normal until he had an attack of stomach "flu" or a cold, or perhaps a fall, when he was about six months old Now these incidents in the baby's short history *could* be the cause of the obvious existing cerebral palsy, but in many cases doctors feel that parents have simply not noticed or admitted that symptoms existed until the child reached six months and it was no longer possible to ignore certain retardations in development There is a definite resistance even among well educated people to accept a diagnosis of "spastic paralysis," because it is still inherent in the public's understanding that these children are degenerate There seems to be a stigma attached to them, and families tend to be ashamed, as they would never be ashamed of a child with infantile paralysis or, for that matter with tuberculosis, though the latter might honestly be considered to present more aspects of blame and censure for the family than cerebral palsy

It is very important that treatment be begun early As far as possible the training of the child with cerebral palsy should follow the development of the normal child If the condition is not diagnosed until the child is three or over, a great deal of valuable time will have been lost Nurses will remember that the average child tends to sit at six months attempts to creep at about ten months and to stand alone at fifteen months In the mild cerebral palsied child, this sequence might have been approximated with but little delay had training been instituted early enough

Frequently parents are tempted to follow advice secured from unreliable sources, particularly about taking the child to unqualified practitioners This tendency is expensive and dangerous, and the nurse must marshal her best (but unhysterical) arguments against it

Probably no parents ever need help as badly as those with a cerebral palsied child Nurses need to know all community possibilities for the care and education of such children, as well as those available in the state and nation Cerebral palsy is an exceedingly complex problem, and the needs of the child for special types of treatment may be very great Specially trained physical therapists, occupational therapists, speech therapists, and teachers may be required The State Society for Crippled Children and Adults can usually give the nurse much valuable help on this problem and will be able to refer her to other agencies for additional help Intelligent, sympathetic information given the family by the nurse

hers in high school whose younger sister "wasn't quite right" The child was kept for years in an upstairs room She was allowed to play only in a fenced in backyard Neighbors nodded their heads, were extremely sympathetic, but spoke of a grandfather whose "wild oats' accounted for this Bad blood will tell, they said One day the student saw the child in the backyard, noticed that she walked on her toes with her knees crossed, that she drooled and laughed raucously The student remembers that she shuddered, watching the child, and that she felt a great repulsion as though she were looking upon something not quite human Now, however, she wonders why someone did not tell the parents of that child that perhaps something could be done for her

IMPORTANCE OF EARLY RECOGNITION AND TREATMENT

Early recognition is an important factor in the treatment of the condition This is not always as easy as it might seem, particularly in the case of the mildly affected child The more severely affected are not likely to be overlooked, for, with the history of a difficult labor, correlation between certain symptoms in the baby and his obstetrical background makes the attending doctor and nurse particularly observant Cyanosis, convulsions, dyspnea, apnea, and twitching indicate an advanced degree of involvement Increased crying, vomiting, hiccoughs, rigidity or tenseness may be present in less severely affected babies All symptoms of this nature should be faithfully recorded on the infant s chart, and in considerable detail Many such babies are also intractably difficult feeders, and this may be a significant factor in diagnosis

In very mild involvement none of the above symptoms may be present As the infant grows older, however, certain features make their appearance which should not escape the nurse s attention Unless, however, the nurse knows at least the elements of normal child development, she will not be prepared to recognize the departures from the normal in these children

It is not at all uncommon for this condition to escape detection until the child begins to walk although delay in walking of itself may be significant Sometimes a tendency to walk on the toes, accompanied by adduction of the thighs and knees may be the only symptoms which are noted at this time

It has been interesting to note that babies of a year or under are frequently brought to doctors offices for some slowness in development,

can be of great benefit The child's moments of rebellion and temper will occur less frequently as he sees his unbecoming behavior duplicated in others like himself in the ward The nurse's manner—quiet, firm, understanding, but unwavering where principle is concerned—will play a great part in the child s emotional development This is so important that the nurse should never underestimate her share in the treatment of these children Too often a complaint is made by the nurse that the physical therapist and the occupational therapist and the teacher are the ones who really contribute toward the rehabilitation of these children, and we as nurses have little to do with it This attitude is quite false The child spends more time with the nursing group than with any other while he is in the hospital The nurse's attitude, her teaching, by precept, example, and practice, can do much toward the emotional development of the child, and this service to him is not to be minimized

Intelligence in cerebral palsy is not measurable by appearance Facial contortions, a raucous voice, emotional instability, gutteral speech, apparent inability to understand what is being said, laziness and lack of desire to do things for himself, do not always signify low mentality Opinions as to the mental capacity of individuals afflicted with cerebral palsy vary considerably Estimations of mentality based on mental tests that require some type of motor response are not considered reliable in giving an accurate measurement of the cerebral palsied child's mental endowment However, as better instruments for measurement are devised and as knowledge of the various types of cerebral palsy increases, a more adequate estimation of the child's educability is becoming possible While too much optimism is always to be avoided until the child has been given the benefit of an examination by a specialist, to recommend custodial care for a badly involved child without such an examination is exceedingly unwise

Defects of speech, hearing, sight, and sensation may be present in cerebral palsy It can easily be seen that any of these defects might make the child seem less alert than he actually is The athetoid is particularly likely to be slow to differentiate between sounds, and his ability to distinguish words may be greatly impaired Defects of sight may vary from lack of control of eye muscles and squinting, to strabismus and nystagmus

Cerebral palsy types are classified as spastic, athetoid, ataxias, rigidities, tremors, and others The list grows as the knowledge of the dis

sometimes prevents a great outlay of expense and energy in traveling from one "healer" to another in search of a miraculous, quick recovery for the child

THE NURSE AND THE EMOTIONAL ASPECTS OF THIS DISEASE

What should be the attitude of the nurse toward these children? As far as possible, it should be the attitude one uses with a normal child It has been repeatedly emphasized that workers in this field must remember the patient is first of all a child and only secondarily a victim of cerebral palsy Friendliness, interest, affection, and dependability should be manifest in the nurse's actions, for the child needs these things and they add to his feeling of security and personal importance It should be realized that the cerebral palsy patients are quicker than many other children to detect an unsympathetic presence They are equally sure to sense a friendly one It is quite essential to secure their confidence and friendship, for upon these things much of the success in treatment may depend Furthermore the nurse is urged to find out all she can about the child she is caring for, both as to background and personal history and as to the improvement which the doctor feels may be possible Has the child come from a home where family life has revolved around him as though he were a pivot? Or has he been shoved in the background and treated with great negligence? The nurse's attitude toward the child may very well have to be altered somewhat by what she learns of his background We know that the education of the parent is a very important part of the treatment of these children Treatment must carry on far into the future life of the child or its value is questionable from the start All treatment for these children is premised on this concept Probably the two features indispensable to the treatment of the cerebral palsied patient are these mental capacity to make treatment of permanent value, and the understanding and cooperation of the parents

Too often the afflicted child has been utterly spoiled by the time he comes to the hospital—it may be because of a parent who has decided, with almost a religious fervor, to devote her whole life to the child to compensate him for being crippled No responsibility of any kind has ever been given him and he has never had to take the consequences for his misdeeds Hospital experience will not be easy for such children, but if the situation is directed by an intelligent and understanding nurse, it

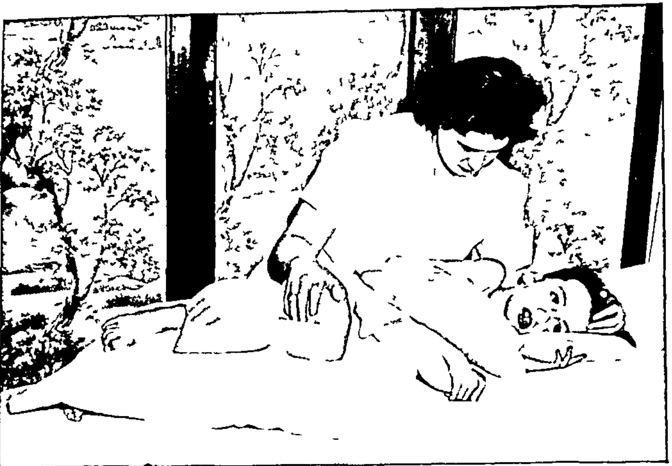


Fig 208—Teaching relaxation in a side lying position The pillows are placed between the legs under the upper arm under the head, and the body is flexed Here the control of athetosis is aided by the use of sandbags (From Egel Technique of Treatment for the Cerebral Palsy Child The C V Mosby Company)

ease progresses The most frequent in occurrence are the spastic and the athetoid, and discussion of nursing care will be confined largely to these

There is considerable variation in the treatment given to the two most common types of cerebral palsy patients The child who presents the uncomplicated cortical involvement—the true spastic—has a set of symptoms which make efforts toward muscle re education the most important consideration These children, confronted by a blocking of their voluntary efforts to perform an action, frequently tend to show signs of gradually developing frustration and apathy There is reason enough to explain this, for each time the rigid spastic attempts a movement, a sort of "tug of war goes on between opposing muscles Normal activity demands relaxation of one set of muscles while the other set contracts, but in the spastic this does not happen Constantly repeated blocking of his efforts may finally convince the child that the trial is not worth the effort, and he becomes harder to motivate than the person not so afflicted Re education of muscles forms the basis of treatment, and muscle checking to ascertain which muscles are strong, which weak, and which normal, is essential to the program But the emotional manifestations which characterize these children need some concurrent attention They are not, as a rule, gregarious or outgoing in their attitude toward others They tend to be fearful of new situations, of unknown experiences They dread sharp unexpected noises and are very much afraid of falling Their fear of falling is based on experience, for a fall in an unrelaxed position is indeed an unpleasant occurrence

The athetoid patient on the other hand can make normal movements without the block in the antagonist muscle which confronts the spastic patient, but he is deluged with a flood of involuntary purposeless movements which are beyond his control He develops muscular tensions very early in life in an attempt to overcome this Relaxation is the basis of treatment with the athetoid Surgery and braces are seldom used since permanent fixed deformity does not occur in uncomplicated cases These children are subject to spells of emotional instability approaching rages, but they are, on the whole more outgoing and affectionate, they like people and are less self conscious than the rigid spastic

In the third type of cerebral palsy, ataxia the chief difficulty may be maintenance of equilibrium Because it is hard for these patients to balance themselves walking may be exceedingly difficult These patients otherwise seem to be less severely involved than those with the two major types of the disease



Fig 208.—Teaching relaxation in a side lying position. The pillows are placed between the legs under the upper arm, under *the head and* the body if flexed. Here the control of athetosis is aided by the use of sandbags. (From Egel: Technique of Treatment for the Cerebral Palsy Child, The C. V. Mosby Company.)

Certain principles apply to all types of cerebral palsy, and to avoid repetition these will be set down together Such treatment as applies to one type or the other is usually ordered by the physician who makes the diagnosis

Relaxation, while paramount in athetosis, is important to all types of cerebral palsy Too much stimulation of any nature is inadvisable Surgical wards, wards used as centers of play for a noisy group of children loud radio programs of syncopated music are not good for these children The environment should be particularly quiet before meals before the physical therapy treatments, and before retiring The need of a controlled environment in the home is also to be emphasized The atmosphere of the ward at all times for these children should be one of fairly even tenor Fatigue comes quickly with even small effort It must be watched for and its symptoms recognized The child tends to want to go on beyond his fatigue level Rest periods need to be a little longer for these children, because they go to sleep only after a considerable period of lying in a quiet room If you will notice them after they have relaxed and gone to sleep, you will observe that their exhaustion is sometimes out of all proportion to the activity they have engaged in One of the chief lessons the patient with cerebral palsy must learn is how to relax voluntarily In order to help the child to do this nurses should be familiar with the methods used by physical therapists in teaching relaxation Sometimes it is possible to help the child by reference to some familiar relaxing incident, experience, or sensation, for example, the child might be asked to try to imitate a soft and cuddly kitten, or a handful of sand or a feather or leaf floating in the wind

SPEECH TRAINING NURSING RESPONSIBILITIES

It is now generally conceded that the ability to talk is a primary need in cerebral palsy, and that it is much more important, for instance, than learning to walk Speech is bound up closely with every other type of learning and every experience might be said to have its speech component Nurses should attempt to follow up the child s periods with the speech therapist by paralleling each experience the child has during the day with conversation appropriate to that experience, i e talk about clothes as the child dresses talk about food as he eats

Speech training for the cerebral palsied child should be given by qualified speech therapists and to be most effective it should be started early, preferably between two and five years of age By beginning this training early it will not be necessary for the child to unlearn the poor

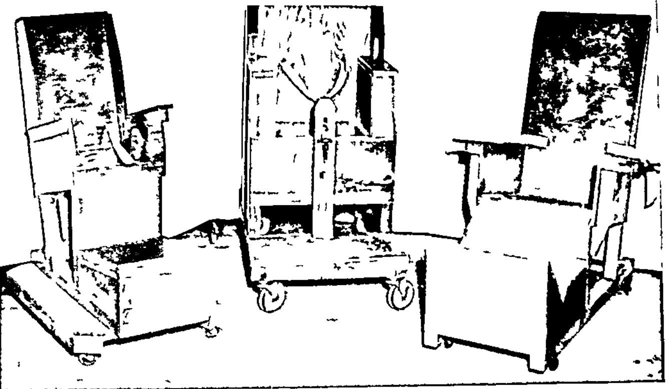


Fig 209 —Specially constructed chairs to promote relaxation in the cerebral palsy patient (From Egel Technique of Treatment for the Cerebral Palsy Child The C V Mosby Company)

habits of communication which children with speech difficulties usually have Parents may help prepare the child for speech training by having regular periods each day devoted to talking to the child If the child is very young, talking should be accompanied by looking at pictures, or handling the objects about which the parent is talking This simple beginning in speech training will aid considerably in the child's development It is a natural tendency for the child to try to imitate and echo the sounds he hears, and the cerebral palsied child should not be deprived of this experience

A factor that must be remembered by both nurses and parents is that the child must be urged to ask for the things he wants If he can get what he wants without asking for it, he will try to do so Speech therapists emphasize the fact that it is not wise to interpret the child's speech by satisfying his wants too easily Much of the motivation to speak more accurately may thereby be lost

While poor habits of speech should, of course, be discouraged on the wards when the nurse knows the patient is capable of doing better, it is unwise constantly to call attention to the child s speech, particularly in a nagging manner An emotional block toward the whole speech problem may be induced by nagging Encouragement and assistance rather than correction should characterize the nurse's approach to this matter

TEACHING THE CHILD TO FEED HIMSELF

Ability to feed himself is an important accomplishment for the child with cerebral palsy Equipment for eating therefore should be optimal Consultation with the occupational therapist will frequently reveal to the nurse ways of adapting existing hospital equipment to fit the needs of the child for handling his own food Spoons can be built up with rubber sponge material, which can be wound around the handle to make a bulky object easy for the child to grasp If this is covered with oiled silk and secured at the base with waterproof tape, it can be washed and dried with the other hospital silver A specially constructed chair with a slight backward tilt and a table with a space hollowed out for the child s body are especially useful If the table can be constructed with depressions to receive a bowl, a glass or cup, so that things will not slide away from the child as he reaches for them, it will be particularly suitable for his use Lacking this feature however, it has been found that small rubber mats, frequently used under tumblers,

will do much to keep the dishes from slipping about on the table It is advisable to have the child's elbows supported by the table as he eats, as much greater relaxation will be obtained in that way The feet should rest on a solid surface, and not dangle in mid air A large water proof bib will give the child freedom from fear of spilling food on his clothes Many other details for making mealtime a more comfortable experience for the child can be worked out so that the period is less an ordeal for both the nurse and the patient than it sometimes is where no special equipment is provided

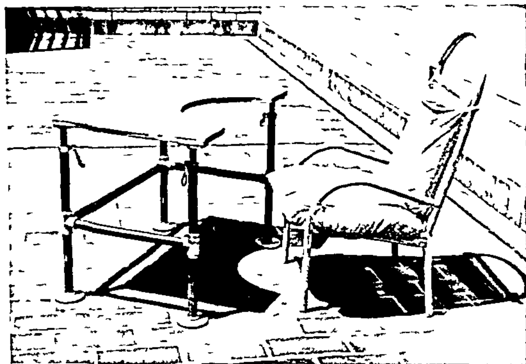


Fig 210 —Adjustable table and chair for cerebral palsy patient Made by hos pital carpenter

Since much of the muscular coordination needed for chewing and swallowing is also necessary in speech, it is advisable that as soon as pos sible, the child be placed on food that requires chewing Chewing will aid considerably in developing control of the jaw and throat muscles Some speech therapists advise that the child's training in swallowing can be aided materially by use of a lollipop In sucking a lollipop the child will learn many of the tongue motions which are necessary in swallowing A drinking straw is useful in helping the child to learn to narrow down his mouth motion

However, most workers with cerebral palsy patients advise that training for eating should not be done at mealtime. To avoid an emotional block, it is better for the child to learn these things at a time when his nutrition is not involved. Training in many of the details which have to do with eating are often incorporated in the physical and occupational therapy programs. Such skills are accomplished very gradually, and the child learns to master one motion thoroughly before he is advanced to another. If he can learn to raise an empty glass to his mouth, first by being guided by the therapist's hand, and then by his own effort, he has advanced considerably toward being able to feed himself. After he has mastered the empty glass, a very small amount of liquid is added to it, and this is continued until he can lift a glass containing the usual portion of liquids.

Drooling is almost always a matter of great concern to the parent of the cerebral palsied child. Training to overcome this habit is usually begun concurrently with speech therapy, as it is considered to be due at least in part to an inactive tongue. Speech clinicians tell us that something can be done for drooling in almost every instance. As the child learns to chew, suck, and swallow, he will automatically develop these reflexes, and this will aid in the control of drooling. It is also possible to aid the child in learning to swallow by having certain periods of the day when he practices swallowing rhythmically. For instance, the mother or nurse may count to five, and the child is instructed to swallow on the fifth count. Repeated faithful efforts in this will show results in the child's gradual ability to control drooling.

The child should have the benefit of quiet surroundings and suitable equipment when he is eating. In the hospital where distractions are numerous this is sometimes hard to provide without depriving the child of the companionship of his own age group. Consultation between *nurse, physical therapist, and occupational therapist* will frequently result in a flexible plan for the child that may be altered as his ability to feed himself and cope with distraction develops.

It must always be remembered that the child may need help, particularly with the last part of his meal. The severely involved patient cannot be deserted and expected to accomplish even minor tasks for himself. He may need help in adjusting his equipment, when he shows obvious symptoms of fatigue, he needs assistance. If he becomes disheartened by being given too much to do, or too difficult tasks to perform, he tends to lose interest and courage. The nurse should keep this in mind even when she leaves him to perform a simple function of dressing or eating. Her encouragement and assistance will do a great deal

to promote in the child a feeling of accomplishment without tiring or discouraging him There is a delicate difference in the matter of creating in the child's mind ability and desire to do things for himself, and confusing him by the assignment of impossible tasks which are beyond his capacity

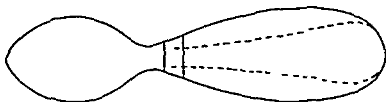


Fig 211 —Spoon built up with sponge rubber and covered with oiled silk to make a good grasping handle for the cerebral palsy child

Fig 212 —Cerebral palsy patient and equipment for assisting her to feed herself Depressions in the table for holding dishes and cups are advisable for the badly involved child

It is essential to teach the child to watch what he is doing Once his concentration span is gone, he learns little by his fumbling efforts The nurse must not be fooled, however, by the child's little tricks of feigning fatigue with a long drawn out sigh or a look of helplessness He is likely

to make tentative trials in this direction for the benefit of new nurses (This is human nature, and not peculiar to cerebral palsy) Understanding of the child's personality, patience, and considerable firmness are necessary in combating these episodes Back of this must be the continued interest in the child's welfare, for he quickly detects when this is absent

NURSING CARE FOR THE PALSIED CHILD IN THE HOSPITAL

Sometimes the child with cerebral palsy is kept in the nursery wards of the orthopedic division long after his age would permit him to be moved This is done that he may remain in a crib A child of eight with fairly normal intelligence does not respond to this kind of treatment, he resents it, it does something to his spirit If the child can be moved into a ward of children of his own age group, some provision for this must be made

A great effort should be put forth to speak to these children very distinctly It is not considered wise to repeat oneself because it seems that the child hasn't understood It may take him several seconds or more, if there is some type of hearing defect, to understand and carry out the order or answer the question given him Remember what he is up against by the mere task of motor response If you repeat your words, you will only interrupt his ability to respond by deluging him with more stimuli Facial expression should be carefully controlled, or he will detect impatience and be discouraged at the outset Speak to him clearly, simply, and directly, and furnish him with sufficient time to comprehend and organize his response Repeat only when he has asked you to do so

It should be recognized from the outset that it is an injustice to the cerebral palsy patient for the nurse to have to rush through his care These children do not do well at the hands of hurried, overwrought nurses Their response to this haste is unmistakable—a tightening of all muscles, rigidity, increased tenseness—the very things the child has been brought to the hospital to overcome If it is at all possible, the nurse should postpone care of these patients until last, in order to be able to give the child more time to attempt to do things for himself This is sometimes impossible because of early morning assignments to physical or occupational therapy, but, where it can be managed, the opportunity should not be neglected Allowing the child to wash and dry his own

face and hands or to brush his teeth may take what seems an unjustifiable amount of the nurse's time, but the reward attendant upon these efforts seems so great that no nurse should possibly overlook it

Toilet habits are not usually difficult to establish in the mentally unaffected cerebral palsy patient and should be begun as early as with normal children Specially constructed low toilet seats with rests for the arms are desirable, that the child may be left alone Continued use of the bedpan long after the child is progressing toward a considerable degree of independence is not wise For the child who spends most of his time in bed, some arrangement should be made to place him securely and comfortably on the pan and leave him alone, rather than to stand at his side holding him, a feature not conducive to good toilet training

Very early in his training should come an appeal to the child to develop proper habits of cleanliness—clean hands, brushed teeth, neatly combed hair This may seem a small matter but it will go a long way toward giving him a feeling of personal worth, without which no other training is of much avail

THE NURSE S RESPONSIBILITY IN TEACHING THE PATIENT

While the cerebral palsy patient is in the hospital, coordination of all the services having anything to do with him must be worked for constantly Methods of relaxation followed by careful muscle re education in physical therapy, hours of urging toward self help in occupational therapy and in the schoolroom, can be undone by the solicitous nurse on the ward if she does not realize that the *ultimate aim of treatment is to enable the patient to care for himself up to the limits of his ability* It is far easier at mealtime to feed the child than to sit beside him guiding, urging, and, if need be, assisting him to eat But if he is allowed to feed himself only on days when the wards are not busy, he is going to lose the urge to do it at all It has been observed over and over again that the child loses the will to feed himself if there are days when the nurse does it for him He likes her presence, and he doesn't have to put forth any effort Another factor that inevitably leads to his caring less about doing things for himself is the fact that he frequently realizes it is such a nuisance to the nurse to wait for him These children are observing they soon catch signs of irritation or bother on their nurses faces It is not uncommon for an athetoid to break into fits of uncontrolled weeping in the middle of a meal for no greater reason than just this he feels

to make tentative trials in this direction for the benefit of new nurses (This is human nature, and not peculiar to cerebral palsy) Understanding of the child's personality, patience, and considerable firmness are necessary in combating these episodes Back of this must be the continued interest in the child's welfare, for he quickly detects when this is absent

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without lifting his feet from the ground, and thereby develops undesirable habits of progression Parallel bars, which furnish a sort of stabilized canelike support for the child, are considered more useful Frequently some type of support for the child's feet can be constructed to give a wider base for standing and walking "Duck shoes" or "ski shoes" have been used for this purpose, and these are firmly fastened to

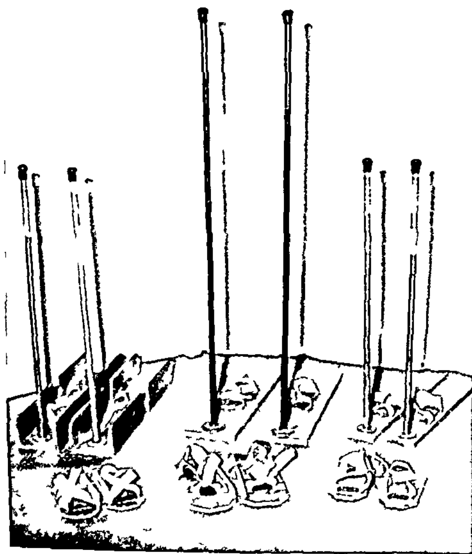


Fig 213—Specially constructed graded skis for assisting the cerebral palsy child in balance and walking (From Egel Technique of Treatment for the Cerebral Palsy Child The C V Mosby Company)

himself a nuisance Probably it must be admitted from the outset that because of this necessity to hurry, hurry, hurry, on the part of busy nurses on orthopedic surgical wards, the spastic child has no business being there

The child s own wants in the matter of attempting new activities deserve consideration The motive is strong at this time, and attention will be directed with greater success at something he really wants to do Guidance is necessary to prevent frustrating disappointments

Since one of the great aims of all treatment is to give the child as great a degree of independence as is compatible with his condition considerable attention must be given toward assisting him to care for his own physical necessities Teaching him to manage his own clothes is a point of great importance This may be a very slow process in the badly involved child and may start with nothing more spectacular than an attempt to fold his garments as they are taken off The less skilled movements naturally come first, but some attempt can be made to prepare him to assume more of the task by allowing him to practice with a good sized doll which has clothes fastened by a variety of gadgets—hooks and eyes, buttons, and zippers, as well as drawstrings and snaps

When the child begins to walk on the ward, nurses should know exactly how the child has been taught to do this in the physical therapy department in order that consistency in instruction may be carried out It is particularly important to note the child s habitual posture in walking and to discourage slumping attitudes or lazy methods of progression It will do very little good on the whole, for the child to have fifteen to twenty minutes careful instruction in the physical therapy department once a day if he is allowed to form careless habits of walking the rest of the time on the ward

Nurses learn from physical therapists of the use of mirrors in the physical training of the child with cerebral palsy It is often a remarkable fact that such a child learning to walk by the aid of lines drawn in front of a mirror will, when he comes within the range of vision of the mirror, straighten his body almost as though by reflex he does not like the look of the stoop shouldered youngster he sees ahead of him, and he will do his best to alter that appearance Physical therapists frequently advise parents to use a weighted doll carriage in assisting the child to walk Walkers are thought by some authorities to be inadvisable because the child, unless closely supervised, tends to push himself along,

cessfully, the nurse will seek to increase the child's ability to relax in other less optimal circumstances This will take time and thought and will be accompanied by many backsets, but the carryover is possible if the child's mentality is normal

POSTENCEPHALITIC CEREBRAL PALSY

The postencephalitic cerebral palsies which follow some virus induced disease which has affected the cortex of the brain are usually severe in nature Loss of motor function occurs, and varying degrees of impairment in speech and intelligence sometimes are so severe in nature that any return of these functions is despaired of However, until a trial is made, pessimistic predictions are hardly justified, for considerable return of function has been possible in a number of the most severely involved patients of this type These children, struck down suddenly, usually from a healthy normal childhood, present a most tragic spectacle because of abruptness and devastation of the disease A hopeless attitude is all too easy for both the nurse and parent in dealing with these children, and often the best treatment that can be visualized by either of them is complete and conscientious care of the child with a view to his physical comfort and cleanliness A more far sighted attitude would be displayed in an effort to utilize the child s unaffected faculties as soon as the acute illness is over Frequently more is left from the wreckage than is at first apparent One very bright boy of fourteen, with extremely severe involvement after encephalitis initiated by measles, was distressed immeasurably bv not being able to make known his wants A perplexed but sympathetic student nurse set herself to work out the problem with a piece of white poster paper She divided her paper into six sections and made a crude drawing in each section In one a bed pan, in another a urinal, in another a glass of water, and so on By standing at the patient s bedside and pointing to the articles one after another, the boy could move his head sufficiently to let her know what he needed at the moment

DRUGS USED IN CEREBRAL PALSY

Many drugs have been used in the treatment of cerebral palsy, most of them in an effort to assist in muscle relaxation Prostigmine and curare have seemed to offer considerable help in certain instances A new drug, Tridione, which acts on the mid brain, seems to be of particular use in athetosis In selected patients it has been shown to have a sedative effect in relieving muscle tension It has not had sufficient

the child's everyday shoes during his walking exercises They are dispensed with as soon as possible, and the child is urged to attempt walking in the normal fashion

The nurse caring for the cerebral palsy patient over a considerable period of time will soon learn that there are certain conditions and occasions under which the child relaxes best Soothing music, gentle,



Fig 214—Duck shoes strapped to ordinary shoes for balancing exercises preceding walking attempts

rhythmic movements of the limbs, warmth, light massage, submersion in warm pools frequently are efficacious in assisting the child to relax But, since she knows that a great deal of the patient's progress depends directly upon his ability to meet new situations and environments suc

This difficulty is not so pronounced in the application of the braces which may be ordered later for the postoperative spastic patient. By the time braces are ready the child is over his postoperative tenderness. It has been found convenient to have the shoes which are attached to such braces cut open to the toes, and eyelets made over the dorsum of the foot, as much easier manipulation of the foot is possible in this way. Grasping the sock over the instep and thereby assisting the foot into the shoe serves to overcome the tendency of the child's foot to go into plantar flexion as the shoe is applied.

Central nervous system operations, such as cordotomy and ramisection, are done much less frequently than formerly. The nursing care for these patients is the care of a patient after a laminectomy in addition to that of a patient having hyperirritability and neuromuscular tension. Noticeable lessening of spasticity is sometimes observed, but it has been noted that this tends to be transitory. Changes in this regard must be carefully observed and recorded by the nurse throughout the postoperative period. The risk attending these is not inconsiderable, and the child will be seriously ill for some time.

TEACHING PARENTS HOME CARE OF THESE CHILDREN

Instruction for follow up home care is so vital that the success of all hospital treatment may be said to be based upon it. Demonstrations of treatments and imparting of a fund of information about the child are far from enough. If possible, the parent should come prepared to spend several days in preparation for taking the child home. The mother should be allowed to see the treatments and nursing care on several occasions and to observe certain emergencies which arise in connection with the child's daily routine, so that she will see how these have been dealt with in the hospital. It is particularly important for the parent to know how serious an error it is to break down or interfere with the patient's nascent sense of his own independence and worth. On the other hand, while parents should be urged to encourage the child in his activities, some warning may be needed if they seem to be overly ambitious for the child's progress. Sometimes the parents' enthusiasm and desire for the child constantly to do better serve only to increase his tension and he may be totally unable to relax in their presence. Furthermore, parents should understand that the child will occasionally go through a period where no improvement whatever seems to occur. These

muscles rather than use force in this circumstance A prolonged immersion in warm water sometimes makes the application of these splints less painful for the child The nurse's humane urge to leave off the splints after an unsuccessful attempt to apply them must be tempered

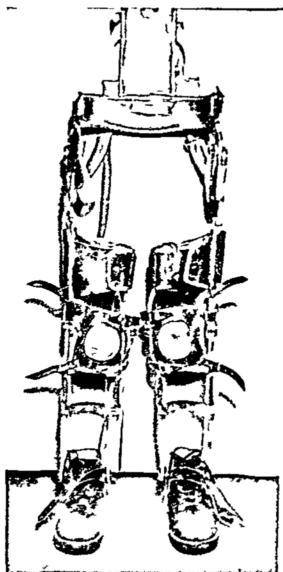


Fig 215 —Long leg braces with pelvic girdle worn by cerebral palsy patient to prevent flexion contractures and to increase stability

by her realization that the tendency toward recurrence of deformity in these patients is very great and much of the good done by the operation may be sacrificed if splinting is not carried out faithfully

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Central nervous system operations, such as cordotomy and ramisection, are done much less frequently than formerly. The nursing care for these patients is the care of a patient after a laminectomy in addition to that of a patient having hyperirritability and neuromuscular tension. Noticeable lessening of spasticity is sometimes observed, but it has been noted that this tends to be transitory. Changes in this regard must be carefully observed and recorded by the nurse throughout the postoperative period. The risk attending these is not inconsiderable, and the child will be seriously ill for some time.

TEACHING PARENTS HOME CARE OF THESE CHILDREN

Instruction for follow up home care is so vital that the success of all hospital treatment may be said to be based upon it. Demonstrations of treatments and imparting of a fund of information about the child are far from enough. If possible, the parent should come prepared to spend several days in preparation for taking the child home. The mother should be allowed to see the treatments and nursing care on several occasions and to observe certain emergencies which arise in connection with the child's daily routine, so that she will see how these have been dealt with in the hospital. It is particularly important for the parent to know how serious an error it is to break down or interfere with the patient's nascent sense of his own independence and worth. On the other hand while parents should be urged to encourage the child in his activities, some warning may be needed if they seem to be overly ambitious for the child's progress. Sometimes the parents' enthusiasm and desire for the child constantly to do better serve only to increase his tension, and he may be totally unable to relax in their presence. Furthermore, parents should understand that the child will occasionally go through a period where no improvement whatever seems to occur. These

"plateaus are part of the natural cycle of the cerebral palsied patient, and too much concern should not be caused by their occasional appearance

In giving instructions for home care to the parents of these children, the nurse may attempt to help them see the advantages of enlarging the child s horizon by means of friendships with other handicapped children, as well as with normal children The orthopedic public health nurse may be of considerable help to the parent in finding these Assisting the child to forget himself is believed by some to be the great major objective of treatment, since loss of agonizing self consciousness is one of the surest ways to improve motor skill Developing such objectivity may be a lifelong job, but the child should be brought to understand that the human race as a whole has the same fight before it The obstacles are greater in cerebral palsy, but the rewards are greater, too, in the realization of the immense obstacles overcome

Some attempt to educate the child s friends and associates in their approach and relationship with him may be advisable Only friends who are by nature considerate of others should be encouraged Outright rudeness or thoughtless remarks made in front of the handicapped person often do much to discourage him from further attempts of a social nature To help the child in meeting the inescapable crises, some explanation needs to be given to him about human nature and its variable response to the handicapped individual He should be brought to realize very early how children and grown up people will frequently display unintelligent ignorant attitudes toward him unthinkingly cruel *on some occasions, foolishly sentimental on others* Perhaps the child old enough to comprehend these things can be made to realize that he himself must develop attitudes of tolerance and forbearance toward limited people His own limitations, after all, are largely physical He should therefore be able to make allowances for errors in others who are even less well equipped than himself

There are many crafts adaptable for the home use of the cerebral palsied child Finger painting is excellent for the child whose hand grasp is poor, and work with clay and embroidery on burlap with yarn and large blunt needles provide training toward muscular coordination Looms and basketry *are also excellent Occupational therapists advise* us that we should be careful to see that whatever craft the cerebral palsied child undertakes should be within his mental and physical capacity The materials chosen for work should not be difficult to handle In addition, the work should be the child's own, not that of the

parent, nurse, or therapist. Motivation can all too easily be destroyed if the many alien hands interfere with the child's progress in making something that he would like to think of as entirely his own.

Community projects for the assistance of the cerebral palsied are numerous, and the alert public health nurse can do a great deal to interest local groups in the subject. One particularly good idea that has been worked out in a community is a so-called "lending library" of equipment for the cerebral palsied, i.e., reclining chairs, specially constructed tables with adjustable legs, dishes, etc. This, of course, entails having a carpenter available who can alter the equipment to suit the needs of the current borrower. As a family finishes using the particular item, it is sent back to the "library" where the carpenter makes the adjustments for the next borrower. Another example of community co-operation is a manual training class in the high school, which has taken on as a special project the construction of equipment recommended by a local orthopedist for use by cerebral palsied individuals.

The public health nurse can be of inestimable help to the parents of these children in many ways. She needs to know definitely what instructions were given the parents before taking the child home. She is entitled to know also the treatment and success of treatment which the child had in the hospital. If these details are made available to her before the child returns home she is fortified to assist the parent and the child in carrying out recommended treatment. It is essential that she have this information before the child goes home so that there will be no intermission or backsliding. Even a week of this can undo much of the good effect of the hospital experience.

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QUESTIONS FOR STUDY—UNIT IX

1 Study and list the possible causes of cerebral palsy

2 What early symptoms might indicate the presence of this condition?

3 Discuss briefly the differences in treatment of the two main types of cerebral palsy

4 Discuss the nurse's part in habit training in cerebral palsy

5 What are some of the problems which might be encountered in the post operative care of the patient with cerebral palsy?

6 Does the cerebral palsy child's physical disability influence his mental and emotional development? Explain

7 Can you visualize the problems a parent and family are confronted with when a child is born with cerebral palsy? What assistance can the nurse give the parent?

When this is the case, the cartilage wears out prematurely and can be the cause of pain in the low back The pain often begins by "catches" in the back and is referred to as the facet syndrome

Asymmetry of the facets is only one of the many anatomic variations that can occur at the lumbosacral area The most frequent anomaly is an incomplete fusion of the lamina of the first sacral segment Another common variation is sacralization of the fifth lumbar segment, which means that the fifth lumbar takes on characteristics of the sacral rather than the lumbar spine

SPONDYLOLISTHESIS

Spondylolisthesis or slipping forward of one vertebral segment on another constitutes the congenital anomaly most likely to produce a backache The presence of spondylolisthesis does not always mean a backache but perhaps 60 per cent do eventuate in symptoms

POSTURAL STRAINS

Postural strains comprise a group of backaches which are mechanical in nature and occur indeed in normal spines in the absence of predisposing cause such as anomalies As the term implies, the strain is the resultant effect on supporting ligaments that resist for long periods any poor posture

The entire group of mechanical backaches has a similar pattern of treatment An attempt should be made in all to detect the predisposing cause, be it a congenital anomaly or a faulty postural habit By eliminating the abnormal stresses the symptoms can be controlled

This is done by teaching the patient the correct positional use of the spine, that is, proper standing position, proper lifting habits, proper sitting positions, and the avoidance of twisting motions Frequently this can be supplemented by a support such as a low back brace or corset, which will act as a reminder rather than a true support for the back Weak musculature should be built up to proper strength by exercises

RUPTURED DISC

Perhaps 10 per cent of the backaches that come under a physician's care will be caused by a ruptured disc As the name implies, a portion of the nucleus polposus, which is the central portion of an intervertebral disc, herniates through the posterior ligament which invests it This herniated fragment of disc comes to lie within the spinal canal, and by

Unit X

COMMON PAINFUL AFFECTIONS IN ADULTS

Chapter 22

LOW BACK PAIN

In recent years there has been an increasing incidence of low back pain, and hence much attention is paid to this disability in an attempt to determine precisely the origin of pain in each case

With a detailed history, complete examination of the back, and adequate x rays it is usually possible to know whether the cause is likely to be infection, tumor, arthritis, or of a mechanical nature Any disease, injury, or affliction known to involve bones or joints throughout the body is capable of choosing the bones and joints of the low back By far the majority of backaches are the result of mechanical stresses, and it is this type of backache which will be discussed

ANATOMY

The anatomy of the low back should be reviewed for an understanding of the nature of mechanical causes of backache The entire spine is composed of vertebral bodies which are separated by discs These discs are resilient and capable of absorbing shock much as do shock absorbers on automobiles This shock absorbing mechanism is Nature's way of protecting the brain from impact shock such as might occur in a jump from a height or a fall on the ice in a sitting position This disc, when injured or chronically strained by repeated heavy lifting, undergoes changes so that it loses its resilience and becomes narrowed This is called degeneration and is commonly painful

The facets are small joints one on either side of each vertebral segment, which form the fulcrum for motion when the spine is flexed, extended, rotated, or bent sideward These facets are covered with smooth articular cartilage which allows easy gliding symmetrical motion when they are normally placed Frequently the facets are asymmetric or anomalous in their *position as a result of congenital malformation*

virtue of occupying space it crowds or actually causes pressure on the nerve roots within the spinal canal Nerve roots when irritated become painful and the pain is radiated along the entire course of the nerve, hence it is likely that ruptured discs will cause pain radiating into the leg and foot This has commonly been called sciatica but the term is not correct since only one of the many nerve roots that make up the sciatic nerve is affected

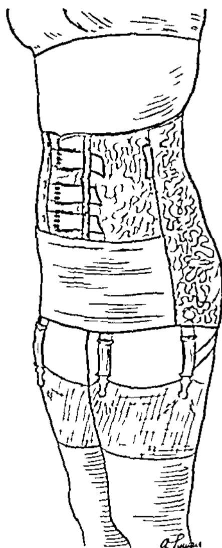


Fig 217 — Sacrolumbar support It is composed of brocade elastic and straps It has a keystone pad over the sacrum and is heavily reinforced with corset stays

Lifting from a stooped position is the most common cause of rupture of the disc Whenever back pain is associated with radiating leg pain, a ruptured disc should be suspected Weakness of muscle groups,

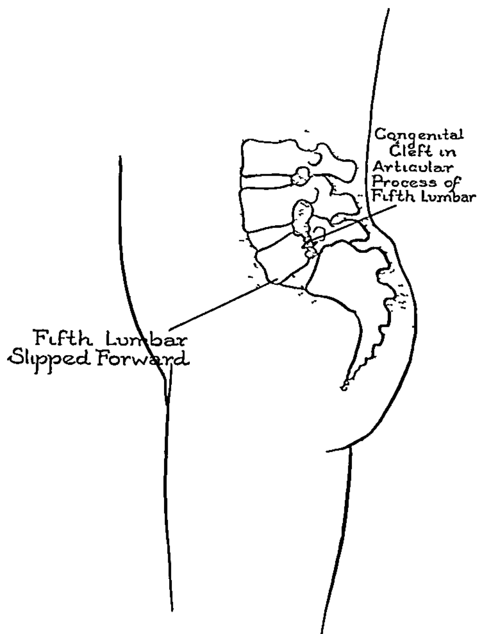


Fig 216 —Spondylolisthesis (Type II)

Chapter 23

NURSING CARE OF PATIENTS WITH CONDITIONS OF THE LOW BACK

Early mild back strain is usually treated by recumbency and heat Adequate recumbency for this condition requires a hard bed and supports under the lumbar spine and knees The support under the lumbar spine should be a hair pillow or folded sheet It should be a *firm support*, and a sheet folded lengthwise is preferable to a feather pillow If the patient prefers to lie prone, he will usually be most comfortable with a pillow under the lower abdomen and another supporting the feet so that the knees are mildly flexed Radiant heat may be ordered or moist hot packs similar to those used in poliomyelitis may be used Prolonged heat, however, will increase congestion, which is extremely undesirable in low back pain Hot paraffin is sometimes used to supply heat in these cases, and it is put on in repeated applications by brush until a thick coating is obtained It will maintain heat in the part for as long as forty minutes Massage is not usually a part of the physical therapy for these patients, particularly in the acute stage, as muscle spasm is somewhat exaggerated by it Deep massage in the less severely involved patient is sometimes of considerable comfort, but it must be used with caution Medications usually consist of aspirin or some other type of salicylate given at three to four hour periods Curare and physostigmine are occasionally ordered for relief of muscle spasm

Back strapping with adhesive tape frequently provides temporary relief in mild cases This procedure is done by the orthopedist, but there are sometimes emergencies in which the orthopedic nurse may be called upon to do this at the request and under the direction of the physician Adhesive strips three to four inches in width are used long enough to extend from in front of the iliac spine, across the back, and beyond the iliac spine of the other side Considerable traction is exerted on each strip as it is applied, and a lumbar pad of felt to supply pressure over the sacral region may be used under the tape From three to four strips of adhesive are necessary, and these extend from the trochanter level to above the iliac crests The patient may be standing for this, or lying in bed When standing it has been found that the patient can provide assistance if he is allowed to stand in a corner and brace himself with

changes in sensation and loss of ankle or knee jerk are helpful signs to localize the particular nerve root that is irritated Another way to determine the exact level of the ruptured disc is by the use of contrast media intrathecally Pantopaque introduced by spinal puncture technique will visualize in the fluoroscope and reveal a filling defect at the site of the ruptured fragment This procedure is known as intraspinal myelography

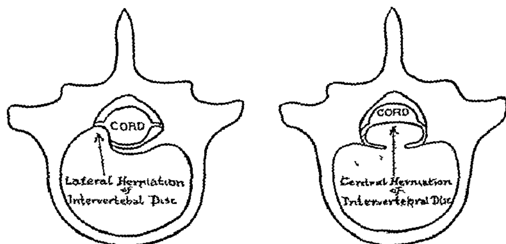


Fig 218—Ruptured nucleus pulposa Showing mechanism of pressure on cord

The treatment for a ruptured disc is likely to be operative, since removal of the protruded fragment of disc will relieve the radiation pain Operative treatment is imperative only where there is evidence of increasing nerve root pressure In milder protrusions nonoperative treatment, namely bed rest, will often relieve the acute symptoms

In all types of backaches so far discussed, spinal fusion can be done to relieve pain when conservative measures have failed The pain will be eliminated when there is no longer motion through the involved segments Fusion is frequently carried out after removal of a ruptured disc in order to stabilize the degenerated level in which the rupture occurred For details of spinal fusion see Chapter 26 Special Operative Procedures

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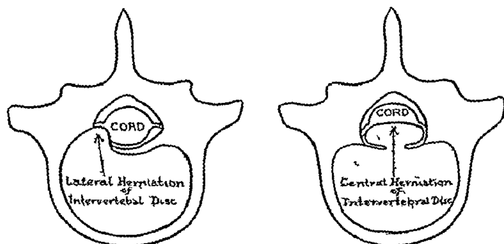


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his hands against the walls Strapping gives only temporary relief, but occasionally symptoms may subside and the patient will be able to return to his work Occasionally strapping is used in conjunction with recumbency or traction The main contraindication here is that the use of heat is restricted because of the presence of the tape

In using such large amounts of adhesive, skin irritation is not infrequent Tincture of benzoin is sometimes used to paint the skin before application of the tape

For severe pain in the low back, traction is commonly ordered Buck's extension in combination with a firm bed and lumbar support often gives considerable relief Excessive muscle spasm may make this type of traction impossible, and some provision for relaxation of the back muscles must be made by the use of overhead suspension in conjunction with the Buck s extension on the legs Hammocks are used to support the calf and thigh, and these are suspended above the bed by the use of rope, pulleys, and weights This traction frequently is very effective However, in the acute stage of this condition, the patient is likely to be uncomfortable in any position, and, for this reason, he is allowed to assume whatever attitude he can find to give him relief Morphine may be necessary to control the pain, which is sometimes so severe that the patient is in continuous agony Nurses tend to minimize low back pain as one of the minor afflictions until they have cared for an acute case and watched the intense suffering which the patient endures from it

When once the acute pain has subsided exercises may be ordered for the purpose of improving the patient s body mechanics and thereby building up a resistance against further back strains due to postural deviations Nurses should make an attempt to watch these exercises as they are taught in the physical therapy department Usually such exercises begin with teaching the patient—first in the lying position and then standing—to flatten the lumbar spine by active contraction of the abdominal and gluteal muscles Diaphragmatic breathing is also emphasized Sometimes the exercises are done by the patient in bed as often as every hour during the day He may be taught to contract the gluteal muscles five or ten times using a steady, slow rhythmical contraction A second important bed exercise for this condition is one in which the patient lies on his back and raises his head and shoulders a short distance from the bed without using his elbows to prop himself This also may be done five to ten times an hour until he is doing the exercise 100 times daily

Soft Pillow under head

Mattress

Hard Pillow doubled over

Sacroiliac pillow

2-3 Fingers Width between iliac crest & sacroiliac pillow

Leister

SACROILIAC POSITION

Fig 219—Bed position for patient with low back pain (From Sacro Iliac Strain by Mildred Hardy Courtesy the American Journal of Nursing)

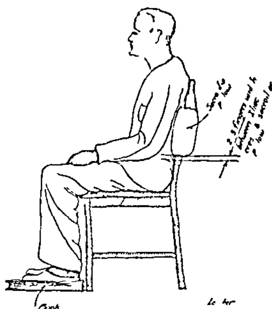


Fig 220—Sitting position for patient with low back pain (From Sacro Iliac Strain by Mildred Hardy Courtesy the American Journal of Nursing)

USE OF THE THERAPEUTIC CORSET

Practically all physical therapy after treatment for these cases is designed to create for the patient a set of corset muscles sufficiently strong to serve as an internal splint for the low back Until this can be accomplished, some kind of corset or brace is customarily prescribed Nurses should understand that a corset for this condition should be prescribed by the physician Patients who attempt to purchase corsets for low back pain without the advice of an orthopedist frequently spend a great deal of money on garments which are absolutely inefficient and may even exacerbate their condition Corsets for low back pain have a dual purpose In the first place they should provide for a type of immobilization for the painful back, and second they should assist in maintaining the trunk in good posture The therapeutic corset is often a somewhat perplexing problem to the student who has relatively little chance to obtain experience in its application Students should be given the opportunity of watching the prescription corsetiere as she does the final fitting, in order to observe points of special importance in the construction and application of the garment

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Fig 221 —Application of corset for conditions of the low back *A* Release the buckles by turning them backward on the straps, holding the buckle between the first finger and thumb and slide toward the end of the strap to within two inches of the end *B* After releasing the buckles it is advisable to bend the bones in the top and bottom in the back in order to conform to the curves of the body *C* (Standing position) Place the support on the body with the center back well down under the gluteus muscles (as shown) the bottom of the front should curve down to the pubic bone the bones of the support if any, should not press upon the pubic bone *D* Hooking the support in the standing position If the top hook of the support is fastened first it will hold the support on the body while the fitter is hooking the rest of the support from the bottom upward *E* (Reclining position) Same procedure as in standing position *F* Fastening side hose supporters In both standing and reclining positions fasten side hose supporters in such a manner that the front portion will draw straight down on the side as shown *G* Pulling the adjustment straps in the standing position Draw slightly the top strap or lacer sufficiently to settle the support at the waist line Then hold the lower straps one in each hand and give a good steady pull thus laying a foundation about the pelvis *H* (Reclining position) The patient must raise her body to enable you to get a proper grip on the straps and to give a firm steady outward pull Procedure is the same as for standing position Caution Always tighten the opposite straps at the same time one in each hand and not first one and then the other *I* Fasten front hose supporters Fasten front hose supporters straight down without tension *J* Inspection of fitting See that there is no slack in any of the lacers if slack is present retrace lacers with your fingers Tuck ends of the adjustment straps backward through the loops designed to receive them When correctly adjusted the back opening should not be more than two or three inches wide if it is a larger size should be chosen Have the patient sit down to make sure that the support is comfortable and that it does not slip from its proper position on the body (Courtesy S H Camp and Co)



A



B



C



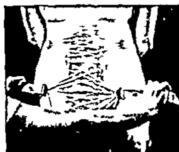
D



E



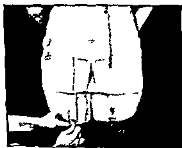
F



G



H



I



J

Fig 221 *(For legend see opposite page.)*

The corset is made to fit the curves of the back so that no loose or gapping spaces occur anywhere Its length must be sufficient to assist in the control of the buttock muscles, and it should be high enough to approximate the lower portion of the shoulder blades The front of the corset must be long enough adequately to support the abdomen Ober states that the fit of the garment over the iliac crests is the most important consideration He recommends that the iliac crests fit into the cloth of this part of the corset as *into a pocket, so that the garment* cannot roll up whatever the activity of the patient

Perineal straps are sometimes used to prevent the corset from rolling up, but these are not considered essential if the fit of the garment is adequate (Sacroiliac belts however, may frequently have this feature attached) Pads made of flannelette sewed into place over the sacrolumbar region of the corset are not uncommon but again these are considered superfluous if the corset is carefully constructed to fit the curves of the back Back lacing is considered desirable for proper fitting in therapeutic corsets

The patient should be observed sitting after the corset is applied to see that it does not slip from its original position A garment which fits loosely or which rolls up is of no value The front stays should not press down on the pubic bone, as this will cause the patient considerable discomfort The garters are an important part of any therapeutic corset and should be kept in good condition The posterior and lateral garters are particularly important for the correct fitting and placement of the corset Nurses should observe that they are not fastened in such a way that they go off at an angle when attached to the hose The front garters must be attached to the hose without undue tension, as tension may make it impossible for the patient to stand erect

NURSING CARE AFTER SURGERY

Stretching of the sciatic nerve under anesthesia followed by the application of a hip spica cast, may be done for conditions of the low back which are complicated by sciatic neuritis, a distressing and very frequent complication The patient is kept at bed rest for a few days and then is allowed to be up on crutches The cast may be kept on for a period of two or three weeks A slight elevation of the heel of the shoe on the unaffected side may be ordered so that the patient will be enabled to clear the floor with the foot in plaster as he walks

Rupture of an intervertebral disc is a well recognized cause of pain in the low back Conservative treatment for this condition may be the

same as for any type of low back pain—namely, recumbency, heat, support, and exercise A semisitting position is sometimes found to be efficacious for the comfort of these patients The backrest is elevated about 15 degrees, and the legs and thighs are elevated on pillows along their entire length Forward flexion of the lumbar spine is thereby encouraged Physicians who prescribe this position do not permit prone lying (hyperextension of the spine) at any time

Laminectomy is sometimes necessary for patients with intervertebral disc lesions The nursing care of a patient after a laminectomy without fusion is a relatively simple problem, quite different from the nursing problem encountered in laminectomy for fractured spines or cord tumors Where spinal fusion is not done simultaneously with the laminectomy, the patient is permitted to move about in bed at liberty and is encouraged to exercise his feet and legs at frequent intervals Nurses are instructed to observe the patient s ability to do this after the operation and to record this carefully during the early postoperative period Blood pressure reading may be ordered postoperatively at frequent intervals Some surgeons order a Bradford frame for these patients, but customarily a hard bed will be sufficient The usual precautions in turning patients with conditions of the spine are observed in the care of these patients The body is turned in one piece, and twisting at the hips is carefully avoided Face lying and side lying are often permitted When the patient lies on his side, a pillow between the legs will provide support for the spine A pillow to support the upper arm will prevent sagging of the shoulder

Postoperative Care of the Spinal Fusion Patient —The postoperative care of the spinal fusion patient will vary somewhat in different clinics, but a general outline will be given here

Shock blocks, a warm bed with rubber covered pillows, and a firm mattress should be at hand where the anesthetic bed is being prepared Some doctors require their spinal fusion patients to lie prone for the first few days, asking that they be turned only for voiding This is usually because they fear pressure and necrosis at the operative site Others prefer that the patient lie flat on his back, without being turned for several days These patients are usually most comfortable if pillows are used to support the legs along their entire length Some relaxation of the back muscles is obtained by this slight elevation Furthermore it is thought by many surgeons to be a means of overcoming a threat of thrombophlebitis in the femoral vessels When arranging the pillows, do not place them in such fashion that flexion of the knee is exaggerated

Place the first pillow high enough under the thigh to support the limb along the full length of the hamstrings The lower pillows support the knee and lower leg on a slight incline without undue knee flexion

When a plaster bed is to be used following surgery, allowance should be made for the dressing which the patient will be wearing This dressing, consisting of gauze sponges and combination pads, is sometimes quite generous, and if no allowance is made, pressure upon the incision is bound to occur The plaster bed must be well prepared for the patient Wrinkles and ridges should be eliminated The doctor preparing the bed will see to it that padding is inserted at the proper points The stockinette must be pulled out to cover all the raw edges and taped down securely Straps are often added to the bed, and its final finishing is done by a brace maker If this is not done, the nurse is responsible for drying the plaster and for having straps with buckles in readiness The entire shell may be covered with stockinette, sewed on neatly The area around the buttocks must be protected with a waterproof material All this should be done before surgery, as the patient can seldom spare either section long enough for repair afterward The advisability of having the patient lie in the bed for a time before surgery is great Any points of discomfort incidental to the shell can thus be discovered before the patient is compelled to lie in it permanently

Where a good plaster bed has been made preoperatively, orders will usually be given to turn the patient for morning and evening care This turning may be done the first evening if the patient's condition permits A severely shocked patient, however, will often do better if allowed to lie quietly till the next morning If the patient lies on his back, careful check of the pulse will be necessary to detect hemorrhage (an infrequent occurrence) since the dressings are not visible

There may be mild and temporary decrease in the tone of the genitourinary and gastrointestinal tract due to the inevitable shock to the sympathetic nervous system Considerable liberty is allowed the nurse in giving fluids to these patients fluids are usually encouraged as soon as nausea is past Diet is increased as the patient will tolerate it

If the patient is an adult it is advisable to have sufficient help that the initial turnings be done with as little discomfort as possible He is naturally apprehensive at this time and everything should be done to give him a sense of security Later turnings will be accomplished much more easily if this is done The patient in a well fitting plaster bed can be turned with relatively little pain to his back If the graft has been taken from the tibia, slight changes of position in the knee joint will

cause muscular pull on the tibia, which occasions the patient a great deal of pain It is important that all who are assisting with the turning of the patient recognize the fact that the knee should not be flexed or extended in the turning during the first few days The nurse handling the leg from one side of the bed should very carefully transfer it to the nurse receiving it on the other side without changing its position Pillows must be ready to receive it before the leg is lowered to the bed The patient may be turned on the leg if this plan seems to be more comfortable for him As a general thing, however, the plaster bed is made with some abduction of the legs and it is easier to turn the patient with the operated leg uppermost After a week or so the pain and muscle spasm in this leg will have subsided, but during the early days it is very acute and is a source of great concern to the patient However, at the present time, many surgeons are taking the graft from the crest of the ilium instead of the tibia Thus, the difficulty in turning and the pain experienced by the patient are somewhat lessened

The patient is moved all in one plane to the side of the bed The undersheet is then changed by a nurse on the opposite side of the bed Pillows are arranged to receive the leg from which the graft has been taken, and a support is made ready for the feet The plaster shell should be securely fastened at the axillary level and around the hips If the cast has been applied after surgery and is still soft and compressible, the bed should be covered with rubber covered pillows where the cast will rest The arms should be placed above the head if this is possible For operations on the dorsal spine, however, it is sometimes better to have the arm on which the patient is to be turned stretched downward along the side of the cast The nurse standing on the side of the bed toward which the patient has been pulled must take responsibility for seeing that this arm is freed immediately turning is done Otherwise the pressure of the heavy plaster bed on the arm may cause considerable bruising The patient is turned toward the clean side of the bed as a unit, care being taken to see that there is no twisting at the hips or knees One nurse can accomplish this if the patient is not too large For a large adult, however, two nurses are advisable One nurse places her hands on the shoulders and hips, the other assumes responsibility for the operated leg, with some assistance from the nurse who stands on the opposite side of the bed

Once turned, the patient should be made as comfortable as possible The feet should be supported on a pillow placed under the ankles so that the toes do not dig into the bed The posterior shell of the cast is

removed, the dressings are carefully inspected for signs of hemorrhage or drainage, and the surrounding skin is washed and rubbed gently with alcohol The circulation of the back, head, and neck is important for the well being of patients who have had spinal surgery and should be given frequent attention Backrubs should include scalp and neck and thighs The patient should be urged to lie prone for as long as he can do so in order to re establish circulation in the dependent areas of back and thighs He may ask to be turned back almost immediately, but a little explanation of the purpose of prone lying will often help in pro longing the period

Turning the Spinal Fusion Patient Who Is Not Immobilized—Spinal fusions are frequently returned with no plaster immobilization Extreme care and gentleness in turning are essential for these patients to avoid motion of the spine which will be accompanied by excruciating pain To maintain good alignment some doctors request that these patients be kept flat and that they be either on their abdomen or on their back In other instances the patient is permitted to move and turn as he wishes When turning a patient from his back to his abdomen follow ing spinal fusion, without benefit of cast or brace, the nurse will apply the same technique used with the patient in a plaster cast First the patient is moved to one side of the bed If the bed is made with a wide drawsheet, the sheet may be used as a slide for the patient This helps to avoid twisting movements of the spine Clean linen is placed on the opposite half of the bed Two nurses stand on the side of the bed toward which the patient is to be turned The patient's arms are kept close to his side, and he is instructed to make his body rigid The first nurse places her hands on the patient s far shoulder and arm, the second on the patient's hip and thigh Slowly and gently they turn the patient onto his abdomen toward themselves Following this it is necessary to move the patient back to the center of the bed This again can be ac complished with the drawsheet When in the prone position the dorsum of the feet need to be supported by a pillow The arms may be placed in any comfortable position

If the patient is turned on his side the nurse will remember what constitutes a good side lying position The pillow, between the legs to prevent adduction of the uppermost limb, will avoid added strain on sore back muscles

Frequently spinal fusion patients are placed on the Foster frame Adult patients can be turned more easily and with less pain when im

mobilized with the frame For care of the patient on a frame, see Chapter 37, Nursing Care of the Fracture Patient

During the early days after surgery, carelessness in turning seldom takes place The patient is so apprehensive that it is necessary to guard one's every movement, lest unnecessary pain be caused him However, after ten days or two weeks, when the patient's general condition is on the upgrade, and the acute pain in leg and back is much diminished,



Fig 222 —Method of turning patient after spinal operation where no supportive apparatus is used A pillow between the legs to prevent sagging of hip would be used if patient were to lie on side Upper arm also should be supported in side lying position

removed, the dressings are carefully inspected for signs of hemorrhage or drainage, and the surrounding skin is washed and rubbed gently with alcohol The circulation of the back, head, and neck is important for the well being of patients who have had spinal surgery and should be given frequent attention Backrubs should include scalp and neck and thighs The patient should be urged to lie prone for as long as he can do so in order to re establish circulation in the dependent areas of back and thighs He may ask to be turned back almost immediately, but a little explanation of the purpose of prone lying will often help in prolonging the period

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Fig 223

Fig 224

Figs 223 and 224 — Spring back body brace This brace is constructed by use of a previously prepared plaster model The pelvic apparatus is maintained in position by an abdominal leather support Note plaster model with outlines for steel construction (Courtesy Arthur Steindler)

haste and carelessness sometimes do occur, for nurses on busy wards tend to try to turn such patients with insufficient help Healing in spinal grafts takes place slowly, as does all bone healing, and gentle handling must continue for many weeks The so called critical time after spinal operations is given as around twenty eight days to five weeks Particular care in handling the patient during these times should be observed No nurse would care to have a spinal pseudarthrosis upon her conscience because of careless handling of the postoperative fusion patient The patient will learn to do much to help the nurse in turning, and fewer people can accomplish the same effect for which many were needed during the first postoperative days However, such things as twisting or piecemeal turning, arching, or sagging of the buttocks and shoulders during the procedure should never be tolerated

Edema of the face sometimes occurs in patients after spinal fusion, particularly if shock blocks are used This can be remedied by removing the shock blocks as early as seems compatible with the patient's general condition A temporary impairment of bowel function is often encountered Enemas are usually ordered between the fourth and sixth day, but they may not be efficacious unless preceded by very mild laxatives or mineral oil Care should be taken to see that rectal impaction does not exist before giving the cathartic Occasionally oil enemas will be more successful than large volume enemas The establishment of regular habits of elimination will soon help to overcome the need for enemas or laxatives and should be part of the patient's routine Care should be taken to support the back and legs of the patient while he is on the bed pan so that all sections of the body are in the same plane These patients will have less discomfort if a bedpan with a tapering back is used in place of the regular bedpan Attention to such details will sometimes pay surprising dividends in helping the patient to resume normal habits of elimination

Patients who must lie prone are in very great danger of pressure areas over the iliac crests This is particularly true of the thin patient in a bivalved cast Reddened or bluish areas around the bony crests should receive immediate attention, for breakdown in that area is extremely rapid The areas must be massaged frequently, and crescent shaped pieces of white felt may be lightly taped around the crests and will often serve to overcome the hazard of prone lying Circular doughnuts, or pieces of felt with circles cut out of the center, are not advisable, for they frequently serve to cut off circulation still further from the part

Another important point to remember is that it is essential that a back brace should allow the patient to sit with the hips at right angles, with no impingement of the metal or the leather on the groin The patient must be able to sit without having the brace pushed up by the chair

Spinal braces, such as the Taylor back brace, are not infrequently used for postoperative immobilization after fusions of the low back (sacroiliac fusion, sacrolumbar fusion, or combinations of the two) These supports are often applied in the operating room, and the patient wears them continuously for a period of several months For back care, he is carefully turned in the brace The metal and leather part of the apparatus is then lifted off the back, but the canvas apron which supports the abdomen is left under the patient as he lies prone, making it an easy matter to reapply the brace once the back is cared for A thin cotton vest of some knit material is always worn beneath the brace

The patient's progress and his resumption of normal activities such as sitting, standing, and walking will depend upon the diagnosis which made the spinal fusion necessary. Fusions for disabilities of the low back usually progress more rapidly than those of patients who have had tuberculosis or similar infections of the vertebrae. It is urgent that patients who are to remain in bed for a prolonged period have constant intelligent care to parts of the musculoskeletal system not primarily involved, but which will be so important to them when they become ambulatory. The physician may prescribe deep breathing exercises, exercises for maintaining muscle tone in the feet, quadriceps setting, and, later, flexion and extension of the knees. The feet should be provided with support to keep the covers from pressing on the toes and for maintaining the normal physiological position of the feet in standing. Knee hyperextension should be eliminated by use of a small rolled towel placed under the head of the tibia, just below the popliteal space. Outward rotation of the hip, if not controlled by a cast or plaster bed, should be prevented by sandbags or a trochanter roll. Unless contraindicated, the patient should be provided with occupations which will insure normal varied use of the arms and shoulders.

The patient will usually be provided with a brace before he is allowed out of bed. It is essential that the nurse know how to apply the brace correctly and that she recognize its importance to the patient's ultimate recovery. The physician will usually order that the patient wear the brace at all times, in bed or out, until permission to omit it for short periods is given.

APPLYING BACK BRACES

Nurses should remember that low back braces and spring back braces may ride up considerably, particularly in heavy women. *Perineal straps* to prevent this are sometimes used but are never very comfortable for the wearer. If the brace has a well fitting pelvic band, this will often overcome the tendency of the brace to ride up. It is a safe rule to remember that in every back brace the pelvic band should fit low enough to hold the upper part of the buttocks adequately. When the brace is applied, the abdominal leather apron must be laced very snugly at the lower portion, diminishing in snugness as the lacing ascends. It is important in applying back braces to observe that the spinal uprights are far enough apart not to press on the vertebral prominences, but also close enough together to fit well between the scapulae.

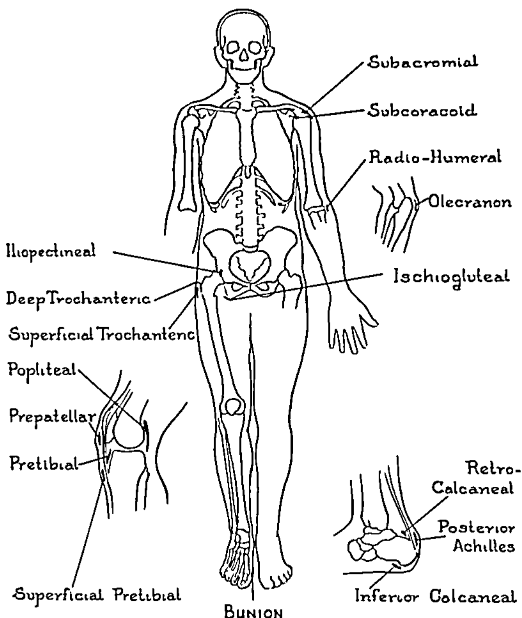


Fig 225 —Locating the most common bursae

Chapter 24

BURSITIS

LOCATION OF BURSAE

Throughout the body there are a number of places where bony prominences are exposed to irritation, either from outward pressure or from the friction effect of tendons, ligaments, and even the skin over bony prominences These prominences are protected by small sacs or compartments which are filled with a lubricating synovial fluid, produced from the walls of the sac This allows the gliding of the various structures over bony prominences without friction A bursa may develop in areas where none normally exists, if persistent irritation continues The ordinary location of these bursae is as follows

1 Shoulder (a) over the acromial process, (b) tuberosity of the humerus (subdeltoid bursa) (c) under the coracoid process

2 Elbow (a) olecranon bursa (b) epitrochlear (tennis elbow)

3 Hip (a) gluteal (under attachment of gluteus maximus) (b) trochanteric bursae (greater trochanter and lesser trochanter), (c) ischial (Weaver s bottom)

4 Knee (a) prepatellar (housemaid s knee) (b) pretibial (under patella tendon) (c) superficial pretibial (over tibial tubercle), (d) popliteal, (e) bicipital

5 Foot (a) Achilles bursa (under attachment of tendo achillis), (b) retrocalcaneal bursa (anterior to the tendo achillis), (c) inferior calcaneal (under the attachment of the plantar fascia to the heel—policeman s heel), (d) bunion bursa this may develop on either the inner or the outer side of the foot when there is a bony prominence of the metatarsal head as seen in hallux valgus

SYMPTOMS

Inflammation of a bursa may develop gradually as the result of a repeated strain or injury or may develop acutely as the result of more severe damage There are pain and swelling and marked tenderness

Chapter 25

DISABILITIES OF THE FEET

ANATOMY OF THE FOOT

The feet small or big must take the burden of weight bearing for various sizes and shapes of bodies They bear the weight of the body when walking or standing and serve as levers in raising and propelling the body forward The bony structure consists of seven tarsal bones, five metatarsal bones, and fourteen phalanges At birth much of this structure is soft tissue (cartilage), and for this reason the foot of the newborn (when deformity exists) lends itself to corrective measures much better than the foot of an older child There are two main arches, the longitudinal and the transverse (metatarsal) These arches are present at birth However, the baby's foot may appear quite flat be cause of a fat pad which fills the longitudinal arch space The medial aspect of the longitudinal arch extends from the os calcis to the head of the first metatarsal The lateral aspect extends from the os calcis to the head of the fourth and fifth metatarsals This arch is supported by two groups of muscles (1) those on the inner and (2) those on the outer side of the ankle The inner group of muscles consist of the tibialis anticus normally attached below the internal cuneiform, the pos terior tibial muscle normally attached to the scaphoid, and the flexors of the toes whose tendons act by leverage under the astragalus (susten taculum tali) to support the arch All these muscles work in coordina tion and are assisted to some extent by the intrinsic muscles of the foot The outer side of the foot is supported by the peroneal muscles—longus, brevis, and tertius These muscles tend to balance the arch elevating effect of the muscles of the inner side of the foot and at the same time work in unison to support the arches of the foot

The metatarsal arch extends medially from the base of the fifth meta tarsal to the base of the first metatarsal This arch is supported by the balanced action between the flexors and the extensors of the toes com bined with the intrinsic muscles of the foot

When muscle action fails from disuse or disease, the strain is trans mitted to ligamentous structures, such as the plantar fascia, and to other ligaments about the joints Strain is often accompanied by inflamma tory change Thus, it can be readily understood, why the patient who

When active motions involve the function of the bursa, pain is greatly aggravated Passive motions, however, are usually not as painful as they would be if there were joint involvement

Acute inflammation of a bursa may develop when bacteria or toxins from remote focal infection settle there

TREATMENT

The causes, such as irritation and infection, should be removed

In the noninfectious types of bursitis, complete rest and the applica tion of heat are important In the extremities, a plaster of Paris cast or a flannel spica often is effective in giving relief The bursa should be locally protected by the use of a "doughnut pad' of cotton or felt

Subdeltoid Bursitis —Subdeltoid bursitis is one of the commonest forms and may need special treatment The subdeltoid bursa is situated between the deltoid muscle and the rotator cuff of the shoulder The inflammation arises in this bursa secondary to degeneration in one of the tendons of the rotator cuff, usually the supraspinatus Into the degenerated area calcium is deposited so that it is possible often to see a calcific deposit in an x ray picture of the shoulder, which is painful as a result of bursitis Pain is the outstanding symptom and frequently radiates down the arm Restriction of motion in the shoulder may be so severe that this condition has been referred to as 'frozen shoulder'

Treatment of subdeltoid bursitis will depend on whether it is in the acute or chronic stage In acute bursitis the treatment is aimed at relief of pain The simplest way to release the calcium which is under tension and responsible for the active pain is to insert a needle and wash out the calcium This can be done with Novocaine At times the calcium is inspissated (dried out to form a hard pebble) and this may require sur gical excision Many times the acute attack will cure itself by absorp tion of the calcium however this may take a period of a few days dur ing which time the patient must be well medicated for pain and the shoulder must be immobilized in a sling

Chronic bursitis does not demand immediate treatment to relieve pain although pain is present The main consideration is to stop irrita tion of the degenerated rotator cuff so that it may heal Avoidance of extreme motion and lifting, plus local heat, may control the symptoms and allow the process to subside Many physicians prescribe x ray therapy, but the beneficial effect is variable Pendulum exercises to re gain lost motion is perhaps the most important treatment

It is difficult for the person who walks or stands in high heels to attain good posture and to practice good body mechanics The weight of the body is thrown forward on the ball of the foot This results in callouses and strain on the metatarsal arch

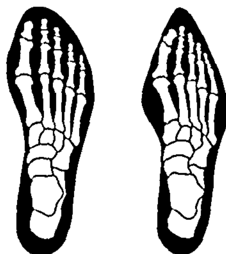


Fig 226

CHILDREN'S SHOES

The baby who has not started to walk needs covering for his feet only to keep them warm These shoes, if worn, need to have soft soles which permit motion of the feet and use of foot muscles When he learns to walk, his shoe should have a thin leather sole sufficient to protect his foot, but flexible enough to permit normal motion and use of the muscles, particularly at the ball of the foot The best shoe for a growing infant, if there is any abnormality, is of the high topped variety with a firm sole, narrow heel, and broad toe

PREDISPOSING CAUSES OF FOOT STRAIN

Foot strain caused by inherently weak muscles can begin with the first steps that a child takes This weakness may persist and cause foot strain throughout life

A second common cause of foot strain is ill fitting shoes There has been a tendency in the past to conform to style rather than to the shape of the foot, and the result has been high heels, narrow wedging toes, and a narrow sole This is at present fortunately being partly overcome and

has been at bed rest needs adequate support for his arches when ambulation is permitted This patient needs a good fitting shoe and not paper slippers

MOVEMENTS OF THE FOOT

When caring for the bed patient, it is essential to know the normal movements of the foot and ankle If these motions are not contraindicated and are performed passively, or actively, joint contractures can be prevented and muscle tone maintained Plantar flexion (equinus position) and dorsiflexion of the foot take place at the ankle joint Inversion (supination) and eversion (pronation) movements of the foot are made possible by the subastragalar joint Adduction and abduction motions take place in the midtarsal joints Flexion and extension of the toes take place at the metatarsophalangeal and the interphalangeal joints

CHARACTERISTICS OF A GOOD FITTING SHOE

Properly fitted shoes are an important factor in the prevention of foot deformities If pain and foot discomfort are to be prevented the shoe size and shape need to conform to the foot The foot must not be forced into an ill fitting shoe The shoe *length* with weight bearing, should extend approximately one fourth to one half inch beyond the end of the great toe A shoe that is too short will cause crowding of the toes and the great toe will be forced into a hallux valgus position A *straight* inner last is desirable Continuous wearing of pointed shoes will result in a hallux valgus deformity and the formation of a bunion A properly fitted shoe must have a sufficiently wide sole at the ball of the foot to permit free movement of foot muscles The length should be proportioned so that the ball of the foot is accommodated at the widest part of the shoe This part of the shoe needs to be flexible to permit bending of the toes The shank should give fairly good support The heavy person or the person who stands for long hours may need a stronger shoe and a more rigid shank than the individual who has a sitting position The shank of a child s shoe, unless ordered otherwise by his physician, should be flexible The heel needs to fit the heel of the foot Sling strap slippers give little or no support, do not hold the heel in position and tend to cause blisters and callouses The height of the heel depends upon the purpose of the shoe A shoe that is to be worn while working or walking should have a heel of reasonable height



Fig 227—Hallux valgus deformity with bunion overlapping fifth toe (right), hammer toes, and corns

there is an attempt to make shoes to conform to the shape of the average foot, but such correct shoes are still none too popular Although ample width is essential in the metatarsal region, a shoe should not be sloppy or ill fitting about the instep and heel One of the common causes of foot trouble, particularly in women, is the tendency of the manufacturers to make shoes which are sufficiently large in circular dimension, but which have the sole of the shoe narrower than the ball of the foot This is likely to cause strain on the metatarsal arch, because pressure is exerted upward along the lateral borders of the foot and, in spite of the fact the individual has ample room within the confines of the shoe itself, there is no freedom of muscle action A frequent statement is If my shoes were any bigger I couldn t keep them on my feet"

A third cause of foot strain is inadequate muscular and ligamentous support (The arches of the foot are supported by ligaments, tendons, and muscles) The child that is growing very rapidly may complain of some foot discomfort Muscular strength is not keeping up with the growth of the body Prolonged inactivity will result in weakness and atrophy of the soft tissues supporting the arches of the foot If weight bearing is permitted in soft bedroom slippers, the patient may develop painful feet Excessive body weight puts an additional strain on the foot The muscular and ligamentous support of the arches may become inadequate and the inevitable is painful, flattened arches Excessive exercise in soft rubber soled shoes, when the individual is not accustomed to such activity, may result in foot strain and pain

BUNIONS

There are two types of bunions, the acquired and the hereditary Acquired bunions are caused definitely by wearing shoes that are too pointed and too narrow or too short

Hereditary bunions are caused at least in part by a congenital abnormality The space between the first and second metatarsals is increased so that bunion development in almost any type of shoe is unavoidable

There is a distinct difference between hallux valgus and bunions The first deformity is of bone and the second is due to an overgrowth of the soft tissue (bursa formation) over the bony prominence developing even in a normally shaped foot

The pain and discomfort from bunions can in most instances be relieved by proper fitting shoes and by support of the metatarsal arch by means of arch supports and metatarsal bars and by sufficiently wide shoes Sometimes the sufferers from these deformities are not willing

pain which is due to arch strain is present only after exertion and fatigue If there is an inflammatory condition accompanying such a strain, it is usually characterized by aggravation of the pain on first arising in the morning or upon sudden activity after short periods of rest Pain which is present only after activity is usually the result of muscle and ligamentous strain rather than inflammation of the joints and ligaments

Treatment is designed to relieve the strain on the tibialis anticus and posticus muscles by means of temporary arch supports made of felt and leather and designed to the individual requirement In addition, a Thomas or orthopedic heel with an inner elevation may also be added, particularly if knock ankle deformity is present Felt is used instead of steel because the latter is rigid and tends to decrease the muscle development for correction

A distinction should be made between the acute arch strain and the permanent or chronic flatfoot In the latter, it is justifiable to use rigid arch supports of stainless steel or monel metal In the acute arch strain exercises with temporary lifts and supports may be of distinct value in restoring muscle power after the strain has been relieved In the chronic flatfoot, however, exercises are of little value It may be necessary at times to use a high top shoe to offset the demands on the muscles which also control the ankle

METATARSAL ARCH STRAIN—METATARSALGIA

The metatarsal arch is supported primarily by muscles, and when the muscular action fails because of abuse or disuse, strain is placed upon the ligamentous structure and upon the arch If strain is severe enough, there is a flattening of the arch and weight is taken on the heads of the second, third, and fourth metatarsals The individual with this condition will develop a callus over the ball of the foot and walking will become quite painful To relieve this pain, felt or rubber pads covered with leather may be placed just posterior to the heads of the second, third, and fourth metatarsals The pad gives support to the arch and relieves pressure The physician may also request that a metatarsal bar (anterior heel) be attached to the shoe (Fig 230) This, again, gives the arch support and relieves pressure on the metatarsal heads

In strains of either longitudinal or metatarsal arches, a support of felt and leather may be designed from the *pedograph* or outline of the weight bearing surface of the foot (Fig 231) It is the object of supports not only to relieve pressure *in the area of the foot* which does not

to accept the type of shoe necessary to relief Sometimes bunions may be so severe that bony correction is required

In this severe type of bunion, operative removal of the bony over growth with about two thirds of the outer side of the distal end of the first metatarsal *head* is necessary

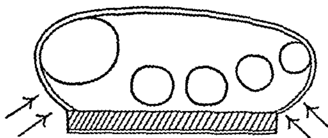


Fig 228—Pressure exerted to cause metatarsal arch strain when shoe is improperly built Such a shoe may have plenty of room'

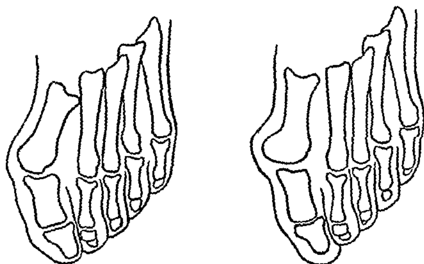


Fig 229—Note difference in angle between first and second metatarsals

In the congenital type osteotomy at the *base* of the first metatarsal may be combined with tendon transplantation according to the method of McBride An osteotomy at the distal end of the metatarsal may also be necessary to restore the alignment

LONGITUDINAL ARCH STRAIN

The pain in this condition both in children and in adults is usually felt in the arch of the foot *and in the muscles of the legs* As a rule, the

apart with the heels just over the posterior border The toes are then contracted alternately one foot with the other so that the towel is gradually accumulated under the arch (2) Marble exercises From ten to twelve marbles are placed on the floor, and by action of the flexor

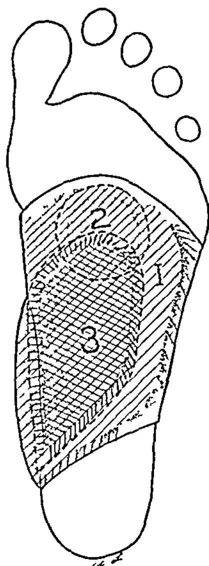


Fig 231 —Design for arch support based on the normal weight bearing surface The pads are of felt or rubber covered with leather Pad *3* fills the normal arch space Pad *1* distributes pressure evenly over a larger area and pad *2* increases pressure under the metatarsal arch at any desired point

tendons they are picked up, moved, and released rhythmically A pencil may also be used (3) The toes may be contracted rhythmically over the edge of a large book upon which the subject is standing

come in contact during weight bearing but to distribute the pressure evenly through the nonweight bearing area and a small portion of the weight bearing area

One of the main requirements in strain of the metatarsal arch is to give sufficient room for action of the muscles which support the metatarsal arch Therefore, adequate width of the shoe in the metatarsal region is necessary Many broad short feet need EE or EEE shoes, which are difficult yet possible to obtain

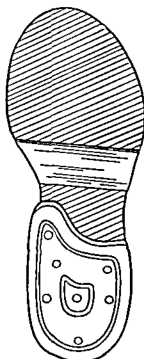


Fig 230 —Thomas (or orthopedic) heel used often in combination with a metatarsal bar

EXERCISES

The above treatment is aimed at relieving the symptoms and enabling the individual to get about without discomfort However, if the condition is to be corrected, the strength of the muscles which normally support the arch must be restored This may be accomplished by active exercises *The following exercises are frequently prescribed to relieve* arch strain

For the Metatarsal Arch —(1) Towel exercises A towel is placed on the floor and the feet are placed parallel to each other about an inch

tendon transplantation of the extensor tendons to the metatarsal heads, or (4), in severe cases, resection of the metatarsal heads or proximal portions of the phalanges



Fig 232 —Clawfoot deformity with retraction of the toes and high arch (cavus)

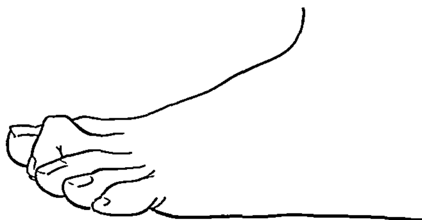


Fig 233 —Hammer toe A corn usually forms on the top and the end of the toe

Hammer Toes may be either congenital or acquired as a result of spasmodic contracture of the extensors of the toes The first inter phalangeal joint is usually prominent and flexed A corn usually de velops on top and on the end of the toe Correction can easily be ob

For the Longitudinal Arch—(1) In the standing position, invert the feet and toes so that the weight is borne on the outer border of the feet Repeat thirty times (2) Rise to the ball of the feet, raising the heels and everting the ankles Repeat twenty to thirty times

For Contracted Heel Cords—(1) Stand on heel, raising and inverting forefoot (2) Stand with ball of foot on edge of stair and drop weight downward, stretching heel cords

These exercises should be done at least twice daily and should be re peated, starting about twenty times each, and increasing to about fifty

OTHER DISABILITIES

There are other causes for disabilities in the foot due to disease, trauma, and disturbances in circulation

Apophysitis is a disease of the heels of growing children as a result of traumatic and metabolic disturbance There is an irritation of the posterior epiphysis of the os calcis Pain and tenderness are character istic Treatment consists in removing the counter of the shoe and tem porarily raising the heel one half to three quarters of an inch Calcium, phosphorus and vitamin D should also be administered

Koehler s Disease is characterized by pain and tenderness and slight swelling about the tarsal scaphoid It is due to trauma direct or in direct and to circulatory disturbances in the bone causing degenerative changes and compression within the scaphoid It is relieved by arch supports and a lift or wedge along the inner side of an elongated heel, or by casts

Freiberg s Disease is a condensation or infraction in the distal end of the second metatarsal usually resulting from trauma and aseptic necro sis and characterized by shortening of the metatarsal, tenderness about the metatarsal head and some strain of the metatarsal arch It is treated by support of the metatarsal arch

Clawfoot and Hollow Foot consists in a contracture of the muscles and ligaments of the plantar arch as a result of relative overactivity of the extensors of the toe as compared to the flexor action This may be influenced or instigated by continued metatarsal arch strain, arthritis, or *spastic or infantile paralysis* The condition is frequently accompanied by calluses under the metatarsal heads and by corns on the dorsal sur face of the interphalangeal joints of the toes The treatment may re quire (1) proper support of the metatarsal arch with arch supports and metatarsal bars, (2) tenotomy of the extensor tendons to the toes, (3)

supports are not often indicated and the correction can usually be accomplished by lifts and elongated heels Where the internal rotation and pigeon toe deformity is not severe and the principal deformity is knock ankle deformity, an elongated heel with an inner lift of one eighth to one quarter of an inch will usually correct the deformity within a few months If a pigeon toe deformity is present, it may be necessary to add to the shoe alterations one eighth of an inch or more outer elevation of the soles

When the pigeon toe deformity is severe with marked internal rotation of the ankle on the knee, it is best to use elastic rotators attached to the outside or the inner side of the shoe They spiral the leg and are fastened to a belt at the waist (Fig 231) The adjustment of these rotators may exert the necessary tension to maintain correct alignment In six to eighteen months, the alignment becomes fixed and the deformity disappears

Bowlegs in children are not uncommon up to the second year and probably compensate for foot deformity, or vice versa Following bowlegs, a reversion to the knock knee status may take place and persist to the seventh or eighth year During this time, frequent changes in shoe elevations may be necessary to meet the current requirements of balance

GOOD HYGIENIC CARE OF THE FEET

Good hygienic care of the feet, daily bathing and massage, will do much to relieve tired aching feet Contrast baths improve circulation and tone of the foot muscles The person who spends many hours on his feet may secure relief from aching feet by changing shoes during the working hours Proper length hose and care in trimming of the nails will help to prevent painful ingrown toenails and dangerous infection The nails should be trimmed straight across Irritation and pressure caused by ill fitting shoes will result in corns and calluses A corn is an overgrowth of the outer layer of skin, and is Nature's way of protecting the soft tissue Pads may be used to relieve the pressure However, to secure permanent relief, it is necessary that the shoe fit properly and that pressure on the area be relieved Maintaining clean, healthy skin about the foot will help greatly in preventing athlete's foot—dermatophytosis Wearing clean hose and permitting shoes to air and sun is of considerable value Blisters and abrasions of the skin should have proper care This is particularly important for the older person who has poor circulation or the diabetic whose tissues heal slowly

tained by resection of a portion of the proximal phalanx so that the toe is shortened and the muscle contracture released

Knock Ankle and Flatfoot Deformities in children are common and are frequently accompanied by bowlegs or knock knees and internal

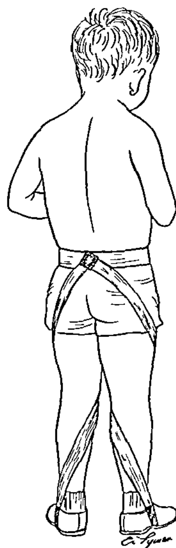


Fig 234 —Elastic rotators attached to shoe below and belt above for the correction of pigeon toes When the child sits the rotators relax

rotation of the tibiae so that the child walks with a pigeon toed and knock ankle gait It is difficult to tell whether or not there is a true flatfoot deformity in young children when they are beginning to walk because of the frequent existence of a fat pad under the arch Arch

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QUESTIONS FOR STUDY—UNIT X

1 Give some of the recognized causes of low back pain

2 Discuss the conservative treatment of low back pain

3 What type of exercise is usually prescribed for low back pain?

4 Name the important points to observe in the application of a corset prescribed for low back pain

5 What is the conservative treatment used for low back pain caused by affections of the intervertebral discs? The operation?

6 What are some of the points to observe in applying a back brace to the patient with low back pain?

7 List criteria you would use in evaluating a proper fitting shoe

8 Describe the bony structure of the foot

9 Why is it important that the convalescent patient wear a good fitting shoe instead of a bedroom slipper?

10 List causes of foot strain

11 Of what value are the foot exercises frequently prescribed to correct foot strain?

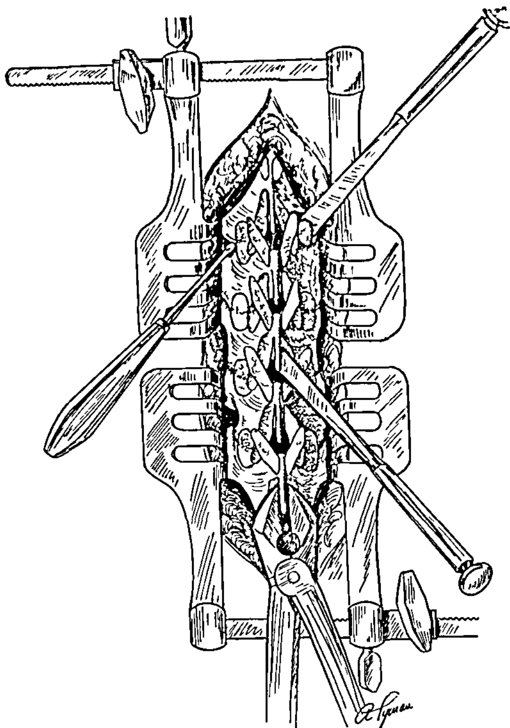


Fig 235 —Fusion of the spine Hibbs method

1 Upper chisel obtaining bone chips from superficial surfaces of articular facets

2 Curette removing cartilage from articular facets

3 Lower chisel producing bone flaps from spinous processes in four directions

4 Bone cutting forceps cutting chips from remaining portion of spinous processes to be laid down center Muscles and ligamentous structure hold chips in place when wound is closed

Unit XI
SPECIAL OPERATIVE PROCEDURES

Chapter 26
SPECIAL OPERATIVE PROCEDURES

This chapter has been included to acquaint the student with the types of operative procedures carried out for disabilities of bones and joints It is not meant to include all varieties of operation but rather to point out broad categories and to discuss a few in detail

ARTHRODESIS

A number of operative techniques have been designed to fuse various joints which are disabling The main purpose of any fusion is to eliminate motion from the joint This is helpful in healing disease such as tuberculosis of the hip, knee, or spine Fusion may also serve to eliminate instability of a paralyzed foot or it may be useful to correct deformity such as might occur in the ankle following a severe injury Most frequently it has been utilized to relieve pain as in spinal fusion

Spinal Fusion—Spinal fusion warrants detailed discussion since it is so common and involves considerable nursing care Fusion of the spine *is accomplished by obtaining solidity between the posterior segments of* the vertebra Usually the solidity is achieved by the use of bone grafts placed on the lamina of the area to be fused

Refinements of technique are diverse and have to do with the type of graft, placement of the graft, and preparation of the graft bed Most surgeons fuse the facets at the proper levels, in addition, to assure solidity of fusion

It has been implied that spinal fusions are done to relieve backache, which is true, but there are other equally important indications Scoliosis can be in part corrected and the correction maintained by fusing the spine in the corrected position Here, as a rule, many levels are fused,

Hip Arthroplasty —In arthroplasty of any joint some material must be superimposed between newly shaped joint surfaces in order to keep the joint from anklylosing In the elbow, fascia lata has been found to be satisfactory interposition material In the hip where weight bearing is necessary, fascia lata is not so satisfactory, therefore, stronger material has been used, namely Vitallium, which is a metal that the body tolerates well Vitallium cup arthroplasty has so far been used mainly for the hip in adults and for the following conditions

Indications for Cup Arthroplasty of Hip —

1 Malum coxae senilis
   Painful hypertrophic arthritis of the aged
2 Traumatic arthritis
   The secondary arthritis which follows surgery
3 Rheumatoid arthritis
   In this condition arthroplasty is indicated to relieve pain, correct deformity, and improve function
4 Unreduced congenital dislocation of the hip
5 Old septic arthritis
6 Complications following fractures of neck of the femur
   A Aseptic necrosis of the head of the femur
   B Nonunions In this condition various types of reconstruction can be done, using the arthroplasty principle with the Vitallium cup The reconstruction will depend on what remains of the original joint that can be utilized

To illustrate what has already been mentioned regarding the importance of supervised convalescence, the following routine is frequently employed after cup arthroplasty

Postoperatively, this patient is placed in balanced suspension traction The purposes of this traction are (1) to provide support for the limb, (2) to maintain the extremity in a position of abduction, (3) to provide increased comfort for the patient, and (4) to facilitate nursing care Bed position and posture (Fig 239) are extremely important for the cup arthroplasty patient The affected limb is maintained in a position of abduction and internal rotation To help the patient maintain this position, the nurse will find it necessary not only to teach him what constitutes good position but that *frequently it will be necessary to help him attain the desired position* A sandbag placed against the medial aspect of the unaffected limb will remind the patient that he must not lie so that his body is diagonal of the bed If this position is permitted, abduction of the extremity is lost A sandbag placed against the chest wall

and the aftercare to ensure fusion must be closely supervised The same is true when fusion has been done to control active tuberculosis of the spine It means to the patient some months in recumbency with im mobilization, and thereafter gradual ambulation with continued support to prevent motion of the spine

ARTHROPLASTY

An arthroplasty is an operative procedure that attempts to re create a joint as nearly like the original as possible This has been applied to the elbow, hip, knee, shoulder, and small joints of the hand, with vary ing degrees of success in the order listed



Fig 236 —X ray showing position of Smith Petersen Vitallium cup after arthroplasty of the hip (From Hip Injuries and Nursing Care by Eleanor Pitman Courtesy the American Journal of Nursing)

The creation of a new joint is truly a reconstructive operation and re quires skill by the surgeon as well as strong will by the patient to achieve a good result At best a surgically constructed joint will not equal a normal joint, but if well done technically it can approximate normal if the patient will faithfully carry out a long program of exercises to keep motion and build muscle strength

against the mattress and to lift the heel off the bed With this exercise the kneecap can be felt to move as the quadriceps muscle tightens As previously stated, it is important that the tone and strength of this muscle (knee extensor) be maintained during the period of bed rest If this exercise is practiced faithfully during the time spent in traction, the process of standing and walking will be much easier With gluteal setting exercises the patient is taught to pinch the buttocks together and to attempt to move the leg to the side of the bed This tightens the abductors (gluteus medius muscle) In addition to these exercises,



Fig 238—*Illustrating method of giving back care to the patient in balance traction* By grasping the trapeze and by pushing with his good extremity with knee and hip flexed the patient is able to lift his buttocks off the bed Because of the balanced weights the splint supporting the affected extremity elevates as the patient's body is lifted

the patient is instructed to dorsiflex and plantar flex the ankle, and to bring the foot into a position of inversion It must be certain that the patient is actually dorsiflexing the foot and not just moving the toes Several days postoperatively the surgeon will request that the head rest be elevated The amount of elevation and length of time will be increased gradually, as the patient is able to tolerate increased flexion of the hip joints When the individual becomes accustomed to this position, he may prefer having the back rest elevated and the hips flexed

on the unaffected side will help him to keep the crests of the ilia level A footboard or bolster for the unaffected extremity will help maintain good position, and when the head rest is elevated, there will be flexion of the hip joints and not flexion of the lumbar spine A small pad placed beneath the lumbar region will many times add to the patient's comfort However, it must be remembered that extension of the hip joint without increased lumbar lordosis is desirable Several days following surgery, the arthroplasty patient should be doing things for himself He needs to be encouraged to use the trapeze for shifting his position and to assist with nursing care procedures Exercise and use of the uninvolved extremity will help maintain muscle strength and prevent generalized weakness

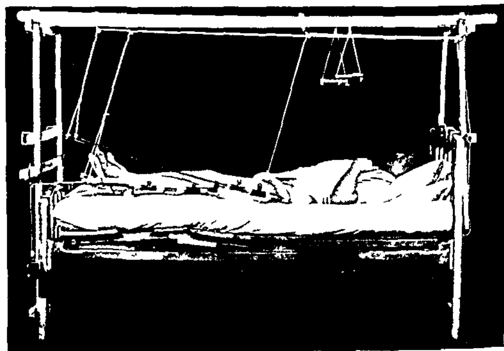


Fig 237 —Postoperatively balanced suspension traction is applied to maintain the desired position of the extremity The half ring Thomas splint with the Pearson attachment provides support for the limb Note the wooden Balkan frame attached to the bed

On approximately the fourth postoperative day, muscle setting exercises are started The patient is instructed by the doctor or the physical therapist pertaining to quadriceps and gluteal muscle setting exercises (Many times the patient is taught these exercises preoperatively) In quadriceps setting the patient is instructed to press the popliteal space

Fig 241 —Skate used with shoe Nurse keeps hand on opposite side of pelvis to prevent further compensating adduction of the normal hip as reconstructed hip is pulled into abduction by patient

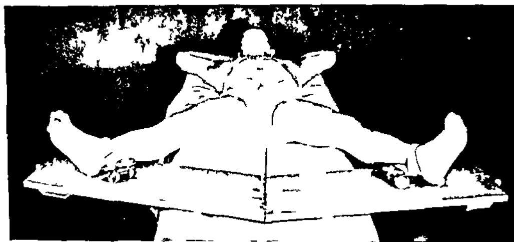


Fig 242 —Roller skates used for developing abduction after hip surgery (From Hip Injuries and Nursing Care by Eleanor Pitman Courtesy the American Journal of Nursing)

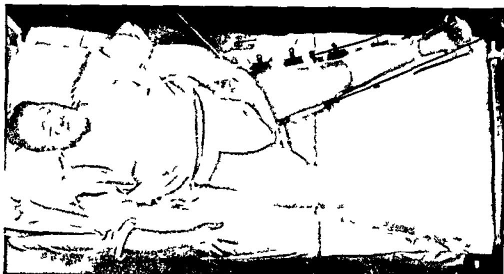


Fig 239—Illustrating the desired position for the cup arthroplasty patient in balance traction Note that the patient is in the center of the bed and that the crests of the ilia are level Both limbs are abducted This position helps maintain the cup and head of the femur in the acetabulum The affected limb is held either in a neutral position or in a position of slight internal rotation

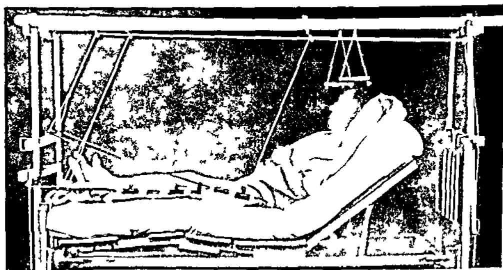


Fig 240—Sitting position for the cup arthroplasty patient with limb in balance traction It is important that these patients be in the sitting position at intervals throughout the day and that their bed be flat at other times The purpose of this is to provide for flexion and extension of the hip joint However the nurse must secure instructions from the surgeon for each patient pertaining elevation of the bed rest How soon postoperatively and how much the bed rest may be elevated will vary depending on the stability of the hip joint

the hip joint and strengthens the abductor muscles With the bed flat, a roller skating board is placed under the patient's feet and the skates are fastened to his ankles The rope attached to the skates is threaded through the pulley at the outer edge of the board The patient abducts his limb as far as possible with his hip muscles, and then by means of the rope he can passively increase the amount of abduction (within limits of pain) However, in the beginning, the nurse must be

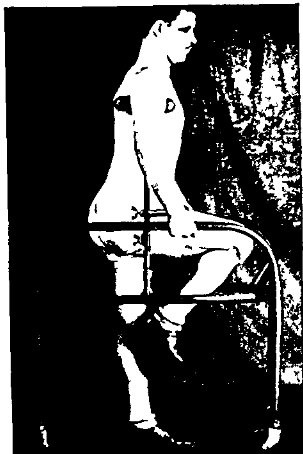


Fig 244 —Walking in the walker Note extreme flexion of the affected extremity When using the walker or crutches the patient should be encouraged to use this type of step rather than a shuffling gait With unilateral cup arthroplasty the patient is taught the three point crutch gait Both crutches are advanced with the affected extremity and the patient takes approximately half his body weight on the involved extremity With bilateral cup arthroplasty, the four point gait is taught left crutch right foot right crutch, left foot The patient is also taught stair climbing This is the same for the cup arthroplasty patient as for any patient with crutches When going down the stairs the crutches and affected extremity are placed on the lower step preceding the good leg When going up the stairs the patient's good leg is placed on the next step and then followed by the crutches and the affected extremity

However, it needs to be remembered that a position which permits complete extension of the hip joints must be assumed at intervals

Within approximately three weeks (depending on the surgeon's wishes) traction is removed Following removal of the traction, roller skating exercises are started This exercise provides for abduction at



Fig 243—The stationary bicycle provides for flexion and extension exercises of the hip and knee joints The patient must sit well back on the bicycle seat and his foot is placed squarely on the pedal He pushes down with his heel and pulls up against the foot strap placed across the dorsum of his foot The first time he may not be able to make a complete turn with the pedal However the nurse must remember that in the beginning all of these exercises are for short periods and are gradually increased to periods of ten minutes or more and are performed several times daily To promote development of the hip muscles resistance may be applied against the bicycle wheel To increase flexion of the hip joint, the bicycle seat may be lowered

individual patient The patient undertakes one gradual exercise after another to keep motion and build muscle until further gain cannot be made After a year or more the new joint will have reached its optimum function, although small gains may still be made year after year

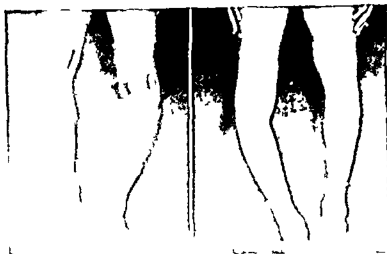


Fig 246 —Anterior and posterior views illustrating extreme bowing of left tibia



Fig 247 —Postoperative picture showing correction gained by osteotomy of the proximal end of the tibia

OSTEOTOMIES

The shaft of any long bone may be malaligned as a result of congenital deformity, disease such as osteogenesis imperfecta, or from a fracture which healed in malposition Any such deformity may be corrected by operative means, this constitutes an osteotomy Where feasible the

alert for signs of fatigue and muscle soreness If muscle soreness devel ops, progress will be delayed Later, this exercise may be ordered two or three times daily for ten minute periods

Usually about the twenty eighth day postoperatively or earlier, the patient is permitted to stand He is assisted to the sitting position and then to the standing position He places both feet on the floor but does not take his full weight on the affected extremity This is the beginning of a period of concentrated exercises, walking with crutches, and special exercises on the bicycle and skates These exercises must be continued faithfully for many months if maximum hip motion is to be gained and maintained Before discharging the patient, provision must be made to supply him with the apparatus needed for exercise in the home

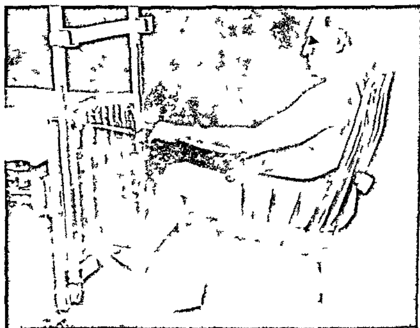


Fig 245—Rocking chair exercises Note that the patient sits with hips well back in the seat of the chair and that the foot of the affected extremity is placed on the bed As he pulls himself forward in the rocker flexion of the hip joint is increased The same effect may be accomplished by placing a sandbag or foot stool beneath the foot Weights may be added to the arm of the chair to pull the patient and chair forward

The types of exercise which promote flexion and extension of the hip joint and which increase muscular strength are illustrated These ex ercises are a very important part of the treatment and care of the cup arthroplasty patient and are ordered specifically by the surgeon for the

ARTHROTOMY

Internal Derangement of the Knee

The knee and the elbow and the phalangeal joints are the only true hinge joints in the body The knee, being a weight bearing joint, is the most susceptible to strain and ligamentous injury Such are common in athletics and industry and usually are the result of twisting motions or lateral strain When the knee is in complete extension, stabilization is accomplished by the internal and external lateral ligaments These become taut in the extended position but relax somewhat in flexion (See Fig 249) The anterior crucial ligament also is tightened in extension and tends to stabilize the joint in complete extension

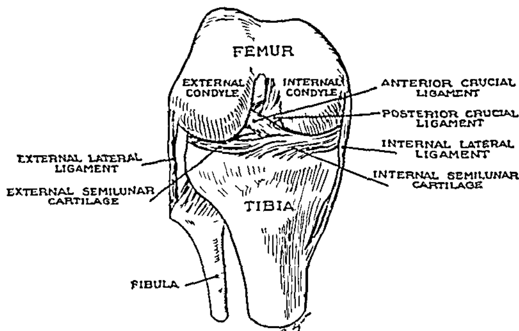


Fig 249—Ligaments of the knee joint and semilunar cartilages shown with the knee in flexion

The posterior crucial ligament prevents forward displacement of the tibia on the femur when the knee is in flexion

Rupture of the anterior crucial ligament may occur when the knee is forced into a back knee position Rupture of the posterior crucial ligament may occur when the force is exerted on the lower leg from behind with the knee in flexion

The most common athletic injury is tearing of the internal lateral ligament It is caused by exerting pressure against the other side of the

osteotomy will be fixed by internal means such as wire, metal screws and plates, bone grafts, or specially designed fixation material The after care will be similar to the treatment of a fracture at a comparable site, for in essence an osteotomy is a controlled fracture

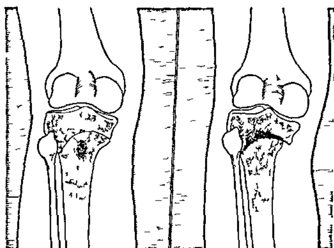


Fig 248 —Line drawing illustrating osteotomy of the tibia used in correction of genu valgum deformity

TENDON TRANSPLANTATION

Several principles might be of interest to nurses in this subject It is well to know the reason in a given case for the tendon transplant

A Substitution —In polio there is frequently residual paralysis of certain muscle groups that can be easily determined In any such circumstance if strong muscles exist in the same extremity the strong muscle may be transplanted

(1) to gain certain function, as in opponens transplant to the thumb, (2) to eliminate bracing, as in anterior tibial substitution

B Replacement —In crushing hand injuries certain tendons may be damaged beyond repair In such instances a tendon from a less important area may be surgically grafted to replace the damaged tendon, and this is known as a free graft

C Realignment —Uncorrected deformities are sometimes increased by pull of normal muscles in an abnormal direction Such muscle pull can be redirected by surgical transfer, so that it tends to correct the deformity An example is a shift of the anterior tibial tendon in a club foot to a more lateral position

Chapter 27

NURSING CARE FOLLOWING AMPUTATION

As in paraplegia, many advances in the treatment of patients with amputation came out of World War II Amputation, however, is a far more frequent condition in civilian nursing than in paraplegia Indeed, amputation occurs more frequently among civilians than it does in military service There were something less than 20,000 amputations in the four years of the War, but there were 120,000 in civilian life during the same period

While nurses may encounter most of their patients with amputations on the surgical wards, there are many orthopedic problems connected with the condition The ultimate problem of the amputee is to learn to walk with a normal gait using his artificial limb, and to attain this he must be instructed in many phases of good posture and good body mechanics

It can be easily recognized that the problem of an amputation in a young and healthy adult is not as complicated as it is in the patient of advanced years who has diabetes, arteriosclerosis, or some other type of perivascular disease Many of the procedures recommended for the younger person will have to be modified somewhat for the individual in less vigorous health The attitude of the older amputee toward walking with the artificial extremity may be one of uncertainty and fear, while the younger person may often be able to walk with such facility that the prosthesis is inconspicuous if not entirely unnoticeable In either case, nurses will need a fund of knowledge which will enable them to offer advice or assistance when the occasion for it arises Besides knowledge of the care required immediately after amputation, they need to know something in regard to stump hygiene, prosthesis construction, and the mechanics of ambulation when the artificial limb is used

CARE OF THE PATIENT AFTER AMPUTATION

Amputation is usually accompanied by a more or less profound degree of psychological shock, which, of course, can be readily understood This condition has been noted even in very young children in whom it is hard

knee when the foot is anchored against the ground This is often called football knee' and requires a period of three to six weeks to heal—the first three to four weeks being spent in a "walking cast" which extends from the groin to above the ankle To prevent the cast from sliding down by gravity, adhesive tape is usually applied over a coat of com pound tincture of benzoin (to prevent skin irritation) and is turned upward at the lower end of the cast Following this a knee support is frequently used for a period of several weeks The re enforced, laced elastic type seems to be the most efficient The knee cage brace with a *steel re enforcement and joint may be preferable in some cases*

Rupture of the crucial ligaments is usually caused by rather severe knee injuries Fortunately, most of these ruptures will heal if cast im mobilization is used for sufficient periods of time If not, operations for the replacement of the ligaments with tendons or strips of fascia become necessary

Rupture of the internal and external semilunar cartilages occurs fre quently Rupture of the internal cartilage is the more common It occurs as a result of a twisting motion The foot is anchored on the ground and the body and thigh twist, when the knee is flexed, so as to cause rotation of the condyles of the tibia on the condyles of the femur Rupture of the external semilunar cartilage occurs as a result of a reversal of this motion

The rupture may occur as a detachment of the anterior attachment of the cartilage or the posterior attachment of the cartilage, or it may be the bucket handle" type in which the cartilage is split—part of it entering the central compartment of the knee joint and part of it re maining in the normal position along the outer margin of the joint Repeated locking is indicative of this type

Treatment —*Immediate operation is not always necessary* in semi lunar cartilage injury Many patients will recover if reduction is accom plished with or without anesthesia and a "walking leg cast' is applied for a period of three to four weeks If there is recurrence, then removal of the cartilage is usually indicated Removal does not usually lead to any interference with the function of the joint There are many active athletes who have had a cartilage removed

Following operation no cast is used, but a compression bandage helps prevent postoperative hemorrhage Motion is begun after twenty four to thirty six hours, stitches are removed in eight to ten days, and walk ing on crutches with tapping is started at two weeks It takes about three months for full recovery

a slightly sagging bed can contribute to the condition, and pillows under the thigh are almost sure to result in some degree of flexion at the hip level

Skin traction may be applied in the operating room or immediately after the patient is conscious Traction is considered necessary to insure good position of the muscle flaps covering the bone or to prevent retraction of skin and muscles after guillotine amputations It is considered particularly necessary when infection is present in the stump Methods of applying traction may vary somewhat stockinette and skin glue, moleskin straps, or rubber surface traction are in common usage

If stockinette is used, the material is rolled, doughnut fashion, and applied over the dressing The top of the stockinette is secured to the skin of the leg above the dressing by some type of skin adherent

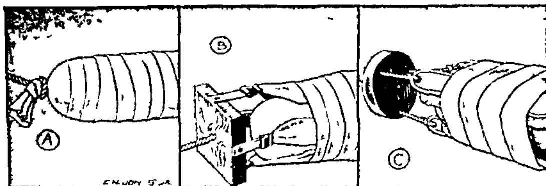


Fig 251 —Skin traction (A) Stockinet and skin glue (B) Adhesive tape (C) Rubber pad (From Slocum An Atlas of Amputations The C V Mosby Company Courtesy the author)

The most commonly used type of traction is made by four adhesive straps which are applied on each of the four aspects of the thigh above the dressing—medial, lateral, posterior, and anterior A circle of heavy wire, stabilized by two crosspieces of wire, or a wooden hexagon may be used as a spreader for the adhesive, rope extends from this spreader to a pulley attached to the end of the bed Five to eight pounds of weight are usually considered adequate

Rubber surface traction consists in lining the adhesive strips described above with thin strips of sponge rubber These strips are then bandaged to the skin above the stump and the weights are applied as in moleskin adhesive traction The suction of the rubber on the skin maintains it in place The advantage of this kind of traction is that it can be removed entirely for physical therapy treatments such as whirlpool baths

to believe that realization of the loss is very significant It seems almost unnecessary to remind the nurse that this condition is fully as important as the physical complications such as shock and hemorrhage, which may also occur The patient will need reassurance from the nurse during the first few difficult days after surgery—reassurance that he is not going to become a cripple unable to walk or to look after his own needs The nurse fully aware of the advances made in the past few years in regard to walking with artificial limbs, may be a source of great encouragement to the patient at this time

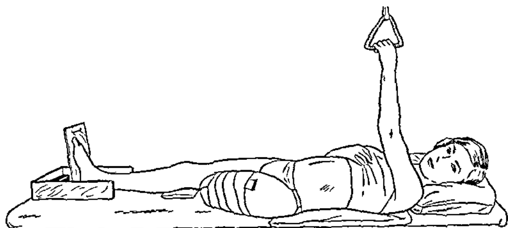


Fig 250 —The pillow under the patient s back facilitates complete extension of the hip (From Nursing Care for the Amputee by Mary Elizabeth Moskopp and Jane Sloan American Journal of Nursing September 1950 By permission of the American Journal of Nursing Company)

The bed made to receive the patient after amputation should be firm and unsagging for a thigh amputation, boards should be placed under the mattress If the amputation is below the knee, a posterior splint of plywood or plaster may have been incorporated in the bandages around the stump to prevent flexion contractures of the hamstring muscles Pillows under the stump are not usually permitted either in thigh or lower leg amputation, because of the danger of flexion contracture at the hip level If a pillow is ordered for the first twenty four hours, care must be taken to see that it is removed thereafter If elevation of the extremity is necessary because of shock or hemorrhage, it is safer to raise the end of the bed rather than to place pillows under the stump Nurses should be alert from the outset to detect signs of flexion contracture at the hip This is a common deformity accompanying amputation, and one that makes efficient walking with the prosthesis very difficult Even

If the patient uses the backrest for long periods during the day, he should be encouraged to spend a comparable period in a position of full extension or prone lying to prevent contracture of the hip flexors.

Two forms of treatment which are almost universally followed after amputation are bandaging and exercise. It is desirable, although sometimes not possible, that exercise be given under the direction of a physical therapist. If such service is not available, nurses must request demonstration from the physician. It is not enough in these circumstances that demonstration be given to the patient alone, as the nurse will need to encourage and guide the patient in the doctor's absence.

COMPRESSION OR SHRINKER BANDAGING OF STUMP

As soon as the wound is healed, the doctor may order some type of shrinker or compression bandage to be applied to the stump. The preferred material for this bandage is usually cotton elastic. Bandages are worn at all times except during physical therapy treatments and exposure to the sun, until the patient is fitted with a prosthesis. A poorly applied bandage is probably worse than no bandage at all, whereas, if it is properly applied, a shrinker bandage may play a most important part in the ultimate rehabilitation of the amputee.

Since, to be most effective, the bandage needs to be reapplied several times during the day, nurses should be familiar with the correct application. Too often nurses are satisfied to leave this task to the physical therapist, but this is hardly a wise procedure since the bandage will frequently need to be reapplied when no physical therapist is available. Occasionally in busy seasons it has been necessary to permit patients to apply their own bandages, but the results from this for the most part have not proved satisfactory.

For the thigh of an average adult, two or three 4 to 6 inch all cotton elastic bandages will be necessary. For convenience and security they are sewed together end to end. The bandage is started on the front of the thigh at the groin level. It may be anchored in place by the patient's thumbs, one on either side of the thigh. It is then carried down the center front of the thigh, over the end of the stump and up the back of the thigh to the gluteal fold, where the patient's index fingers may secure it. (Unless the patient is very large, his hands should be able to encircle his thigh in this fashion.) Now the bandage is carried down the back of the thigh, going somewhat obliquely over the end of the stump this time, back up to the groin level, then down obliquely again, this time over the inner aspect of the stump. Each time the recurrents are held

Inasmuch as a great deal of the patient's future ability to walk will depend on the remaining limb, care should be taken to maintain it in normal muscle tone, and to provide supports to encourage good anatomical position in bed A sensitive heel sometimes develops on this foot, because of the patient's inclination to push himself up in bed by digging his heel into the mattress An overhead trapeze will help the patient to bring himself up in bed without using the heel

The patient may be ordered out of bed as early as the day following amputation as a means of overcoming the danger of embolism He should be fitted with a good shoe when he begins to bear any weight on his foot

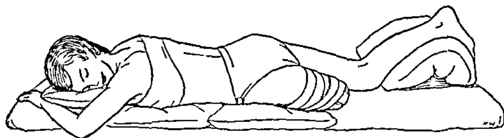


Fig 252 —Prone position The pillow under the patient s lower trunk protects the wound from pressure on the bed and maintains the hip in extension (From Nursing Care for the Amputee by Mary Elizabeth Moskopp and Jane Sloan American Journal of Nursing September 1950 By permission of the American Journal of Nursing Company)

Authorities tell us that the most common causes of trouble when the patient begins to stand are contractures of the hip flexors and the abductor muscles To prevent these complications, the surgeon may order that the thigh amputee lie prone for half hour intervals several times during the day He is instructed to bring the stump close to the good leg, to lift it, and to contract the gluteal muscles as he does so Nurses supervising this bed exercise should see to it that the patient lies with his foot over the edge of the mattress and that he keeps the good leg on the mattress while he is extending the stump Another exercise the surgeon may sometimes suggest is that of squeezing a pillow between the thighs

These things will not be difficult to encourage in the case of the healthy adult, but the depleted elderly person with some perivascular disease will need to be encouraged by frequent explanations as to the necessity of what he is doing Otherwise, it tends to seem too much trouble to him to warrant the effort he must put forth

spiral to the end of the stump is then made, and a second spiral is done as before, always working from within outward and always using the bandage to compress soft tissues at the stump end The bandage is finally brought back to the stump and completed by a few spiral turns as the length of the bandage allows It may be secured by safety pins or bandage clips

The finished bandage should be observed to see that the crossings of bandage to make the hip spica do not lie on the front of the thigh—a condition which encourages hip flexion Also care should be taken to see that the bandage covers the inner surface of the thigh as high as possible on the groin If this is not done, a fleshy roll will be likely to occur at the top of the bandage which will be uncomfortable to the patient and will also cause the bandage to work downward from that level Care must be taken not to bandage an *unhealed* stump too snugly, and bandages for healed stumps should not be applied so snugly that actual discomfort results

The below knee bandage is applied in much the same manner as the one for the thigh stump, of course omitting the hip spica If the bandage extends above the knee, the patella should remain uncovered, and the leg should be held in extension Care should be taken not to compress the popliteal area by too snug bandaging

Since compression bandages must be reapplied several times during the day, it is advisable to have several sets on hand Between each wearing they should be carefully washed with a mild soap and warm water and very thoroughly rinsed They should be squeezed out and laid on a flat surface to dry since they tend to lose their elasticity if hung When dry, they should be rolled snugly but without stretching

PHYSICAL THERAPY

Heat, massage, and exercise contribute a great deal toward preparing the stump for efficient weight bearing These treatments should be done by an individual trained in physical therapy, if at all possible Otherwise, the nurse entrusted with the treatments should seek explicit instruction and demonstration from the doctor before beginning the task

Massage may be started by the seventh postoperative day if no infection is present Massage is beneficial in reducing stump edema as well as in helping to loosen adherent scars over the stump end *Heat in some form will usually precede massage*

Radiant heat may be given by infrared generator or by an electric lamp baker It is particularly valuable in improving local circulation

by the patient's fingers and thumbs, and each time care is taken to compress the end of the stump securely The maximum force of the bandage should always be at the stump end and should diminish as the bandage ascends These recurrents (3) are then secured by one or two circular turns of bandage around the thigh, at groin level, and the patient may remove his hands

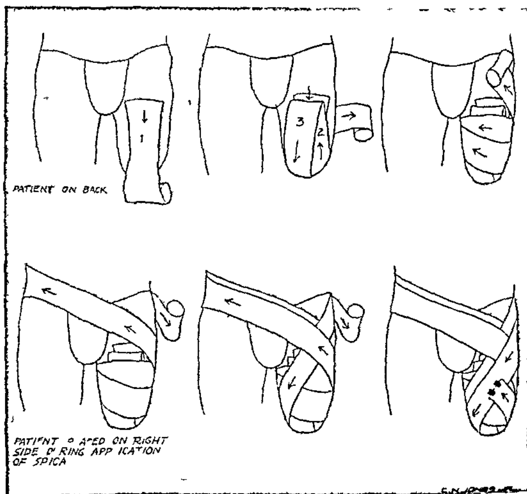


Fig 253—Application of compression bandage (From Slocum An Atlas of Amputations The C V Mosby Company Courtesy the author)

Two spirals downward to the end of the stump are now made and the patient is turned on his good side The bandage is then carried spirally upward around the thigh taking care to compress the soft tissues on the sides of the stump in an upward and outward direction, and then over the outer side of the buttock and the crest of the ilium It thence crosses the abdomen at the navel line, then goes around the hip of the good leg across the back and around the amputated leg, at the groin level A



Fig 254

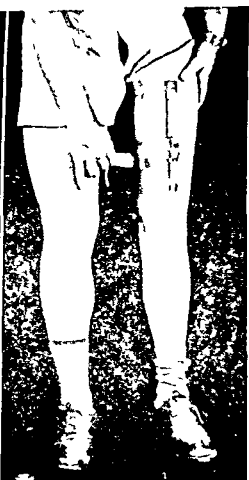


Fig 255



Fig 256

(See opposite page for legend.)

The stump sock, which is always worn with the prosthesis, should be made of pure virgin wool The patient will need to have two or three of these on hand, as they must be changed at least once daily In hot weather more changes will be needed Socks should never be used if they are torn, patched, or roughened, and they should fit snugly except at the end Wrinkles in the sock will inevitably lead to irritation and discomfort These socks need special care They should be washed with a mild soap in lukewarm water and rinsed several times The wool sock should be squeezed dry, not wrung, then spread flat or placed on a sock stretcher to dry Three measurements are needed when ordering stump socks These are the circumference of the upper rim of the socket, the circumference of the distal end of the stump, and the length of the stump (distal end of stump to the place where the upper rim of the prosthesis strikes the leg plus a couple of inches to turn back over the socket of the prosthesis)

Some shrinkage will continue in the stump over a period of years and it is not unusual to find patients attempting to fill in the space between the stump and the socket by wearing more and more stump socks If the nurse discovers that the patient is wearing three or four of these to raise the stump she should advise him to contact the limb maker at once as a new interliner or even a new socket may be necessary The maximum number of stump socks worn at one time should not exceed two

The patient must recognize that any abnormality or discomfort such as swelling, redness, irritation, or induration is a danger signal that needs immediate attention When these things occur, he must stop weight bearing until suitable adjustments can be made in the socket of his prosthesis

THE PERMANENT PROSTHESIS

Artificial limbs may be made of wood, fiber, plastic material, or leather Willowwood is probably the most commonly used material, as

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Fig 254 —A thin cotton sock is placed on the stump Note that a string is attached to the bottom of the sock when the stump is placed in the limb this is threaded out through the valve to facilitate drawing the sock from the stump

Fig 255 —The stump is placed in the limb and the sock is pulled out through the open valve

Fig 256 —Weight is placed firmly on the limb to evacuate any possible air the suction valve is closed The limb is now ready for use and is maintained on the stump through negative pressure and muscle action

(From Slocum An Atlas of Amputations The C V Mosby Company Cour tesy the author)

habits which are acquired early by the artificial limb wearer are extremely hard to overcome, but a great deal of improvement is often possible if the patient understands what is expected of him and if he is given practical suggestions for increasing his ability to use his limb more effectively

REHABILITATION OF THE AMPUTEE

The young individual who has had a single limb amputation and has been fitted with a prosthesis and trained in its proper use should be able to carry on an active self supporting life His family and friends should recognize that the greatest help they can give such a person is to treat him exactly as though the amputation had never occurred The problem of the individual with a double amputation is manifestly more complex Where it is at all possible such individuals should be given the benefit of specialized therapy—physical, occupational, and vocational—which will enable them to attain the maximum degree of independence.

Where amputation has followed some systemic disease, vitality is usually lowered and habits of invalidism are all too easy to acquire This type of patient may tend to prefer a wheel chair rather than to struggle with the problem of the artificial limb However, as the general health improves, effort should be put forth to have the patient resume his normal activities in so far as is possible Sensible weekly goals set up for him to work toward, accompanied by encouragement and an attitude of hopefulness on the part of the public health nurse, will often pay good dividends in the patient's increased capacity and willingness to care for his own needs

it is light and easy to manipulate An artificial limb must of course be specially constructed to the patient's measurements—it is no mail order procedure The socket in particular must be skillfully cut to fit the stump contours

The lower peg prosthesis may weigh around 5 pounds, while the thigh prosthesis will average 7 pounds or slightly over It is extremely difficult for the patient to become accustomed to using a prosthesis which weighs considerably more than this

The patient is usually given instructions by the limb maker for caring for his prosthesis, or if he is an elderly person, some member of the family may be provided with these instructions A wrench is provided whereby the patient may keep the knee and ankle joints tightened He is taught to grease the prosthesis to prevent annoying squeaks He is also instructed never to allow the limb to become wet, as this may do irreparable damage to the appliance

Suction Type Prosthesis—The past few years a suction type prosthesis for the above knee amputee has come into considerable use This prosthesis is one that has been used in Germany quite successfully for some time The prosthesis is maintained on the stump by means of negative pressure and muscle action Its advantage over the ordinary types of prosthesis is that it eliminates the use of cumbersome pelvic and shoulder belts

To apply the prosthesis the individual places a cotton sock over his stump The stump is placed in the limb socket and the cotton sock is threaded out through a small valve placed on the medial aspect of the prosthesis As the sock is pulled through this valve, the patient s weight is placed firmly on the limb and the suction valve is closed

The public health nurse inspecting a prosthesis on a home visit should observe the apparatus for loose or worn out joints, for signs of deterioration in rubber, leather, or other fabrics, and for signs of wearing or cracking in the wood Any of these things are indications that the prosthesis should be seen by the limb maker at the earliest possible moment She should also observe the condition of the stump socks which the patient is using The skin of the stump should be inspected for swelling or irritation If the stump seems hard and indurated, the socket is probably faulty and will need adjustment The patient should not be allowed to go on using the stump in this condition until irreversible changes have taken place in the stump

She should also observe the patient s habits of walking to see that he is making the best mechanical use of the prosthesis Poor walking

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QUESTIONS FOR STUDY—UNIT XI

1 What common deformity often occurs after mid thigh amputation?

2 Discuss nursing measures which will prevent flexion contractures of the hip following mid thigh amputation

3 Describe method of applying compression bandage to stump

4 What will you teach the amputee pertaining to the care of his stump and prosthesis?

5 How is the suction type prosthesis applied?

6 How will you give back care and change the bed linen for the patient in balance traction?

7 Describe the optimum position for the affected extremity following cup arthroplasty

8 Describe exercises prescribed for the cup arthroplasty patient Why are these exercises so important for this patient?

9 Why may it be harmful to elevate the backrest of a newly operated cup arthroplasty patient?

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Unit XII

FRACTURES AND DISLOCATIONS, SPRAINS, AND OTHER JOINT INJURIES

Chapter 28

INTRODUCTION

CLASSIFICATION

1 Nonpenetrating or simple Those in which the skin is not broken either by means of the damaging force from without or by a bone spicule from within

2 Penetrating or compound When the skin is broken and there is exposure of the bone from without or within

Either class may be of several types

1 Transverse
2 Oblique or spiral
3 Greenstick
4 Comminuted
5 Pathologic (collapse)

GENERAL PRINCIPLES

A surgeon may feel reasonably safe if he has seen to it that x ray pictures taken after reduction of fractures and dislocations show proper reposition of fragments and either a perfect anatomical or good functional alignment, or that the result approaches the nearest possible degree of perfection under the existing conditions X ray records are important for information and from a medicolegal standpoint

If, in young children, fractures may have healed with some deformity, there is a tendency on the part of nature to overcome such deformity during growth This tendency decreases with age and disappears almost entirely in late adolescence

Fractures are composed of two parts of the bone, the proximal, which is closest to the body, and the distal or remote fragment or fragments

The position of the proximal fragment cannot usually be influenced by manipulation. Its position is governed by the pull of the muscles which are attached to it. It is called the *uncontrollable fragment*. The distal or remote fragment, however, can be manipulated into the position assumed by the proximal fragment and therefore is called the *controllable fragment*.

This is of great importance in the reduction of fractures and is the basis for treatment. A thorough knowledge of muscle mechanics is essential to good fracture treatment. The stronger group of muscles always predominate in the tendency to the development of deformity.

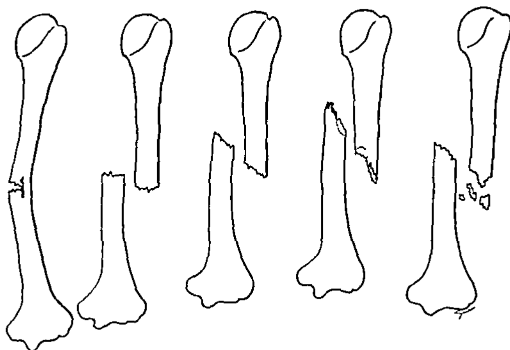


Fig 257.—Fracture types

The "critical" time varies in most fractures and with the age of the patient. It is the time at which soft callus begins to turn into hard callus. (It should be noted that, in the newborn, fractures of the long bones may heal within ten days to the point where further immobilization is not necessary.) During the "critical" time, a disalignment or incomplete reduction, if it exists, can be corrected. This may be done by *wedging* the cast or with properly designed manipulation. It is sometimes an advantage to leave a fracture temporarily in a state of imper-

fect alignment The fracture may be compounded, and changes of position might stir up trouble or disturb skin healing, or the good position of contact of the fracture might be obtainable in this abnormal position and not in the more perfectly corrected position Such facts are brought out during blind manipulation or fluoroscopic control Correction should be made, however, *before* the stage of solid callus formation

FRACTURES AS A MECHANICAL PROBLEM

In whatever manner traction is obtained, watch the effect and efficiency of the apparatus The requirement for perfect anatomical reduction is greatest where there is the least amount of muscle and soft tissue about the point of fracture, for example, near the wrist or ankle Fractures of the long bones are described as being in the proximal third, the middle third, or the distal third

Chapter 29

FRACTURES OF THE SKULL, FACE, AND JAW, FRACTURES OF THE CLAVICLE (COLLAR BONE), FRACTURES AND DISLOCATIONS OF THE SHOULDER

In the statistics of World War II, fractures of the skull were relatively infrequent and when they occurred they were problems for the *neurological surgeon* and required special instruction from him as to the nursing care Similarly, serious injuries to the face involving the nose and sinus were problems of the *nose and throat specialist,* whose ingenuity was often taxed in evolving methods and apparatus capable of restoring and maintaining the position of misplaced fragments

Fractures involving the jaw usually call for the special attention of a *dental surgeon* However, there are certain principles in the treatment which might be mentioned Loose teeth near the fracture line should not be removed unless absolutely necessary Sometimes the alignment of the teeth and jaw may be obtained by wiring together the teeth of the upper and the lower jaw Occasionally the fragments of the jaw bone may have to be held together by wires through the bone Sometimes metal bands may be required to supplement wiring and sometimes plates fastened along the teeth, attached to a plaster of Paris headgear by means of wires and elastic bands may be used for adequate correction

DISLOCATIONS OF THE JAW

Cause —Usually (1) violent yawning or yelling and (2) blows against the chin

Anatomy —The dislocations may be unilateral or bilateral and consist usually in the forward or inward displacement of the condyles of the mandible from the articular surface on the skull

Symptoms and Signs —Forward protrusion of the chin and inability to close mouth If the dislocation is unilateral, the chin is displaced away from the dislocated side There is usually rather severe pain and muscle spasm, and the lips and tongue become dry

Treatment —Simple dislocations of the jaw can usually be reduced without anesthetic The surgeon swathes his thumbs in gauze and bandage to prevent possible biting Pressure is exerted against the lower molars with increasing force downward and backward until reduction takes place Following reduction, the upper and lower jaw should be held together by bandages around the head (Barton four tailed bandage) for a period of two to three weeks, so that habitual dislocation does not develop

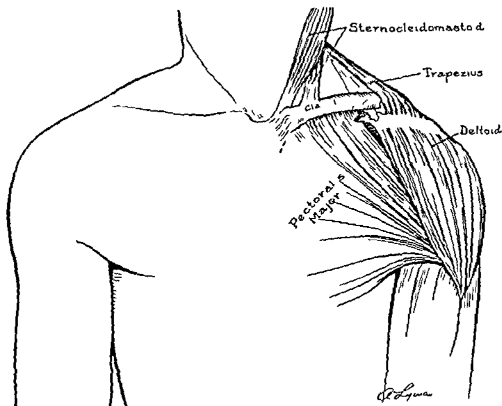


Fig 258 —Muscle mechanics of fracture of the clavicle The sternomastoid pulls upward on the proximal fragment while the weight of the shoulder pulls down and the pectorals pull inward and forward tending to override the fragments

FRACTURE OF THE CLAVICLE (COLLAR BONE)

Fracture of the clavicle is one of the commonest of fractures It may occur in any part—inner, middle, or outer Treatment may be different for each type

Cause —A fall on the shoulder or outstretched hand, exerting the entire force on the clavicle Occasionally, a direct blow

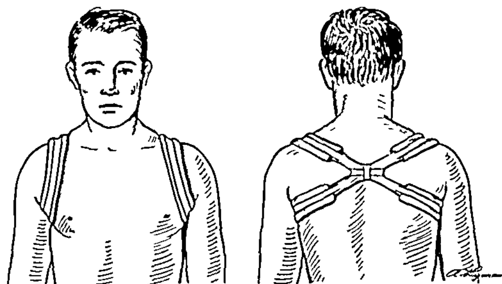


Fig 259—*A* Front view of figure of eight dressing, *B*, back view Felt bias flannel bandage and adhesive are used Dressing should be changed every week or ten days for cleanliness

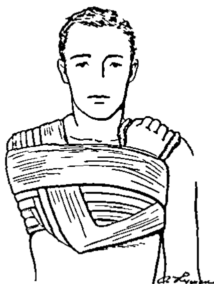


Fig 260—The Velpeau bandage Used temporarily to immobilize clavicle shoulder humerus elbow or forearm Wherever skin comes in contact with skin a protective pad should be inserted

Anatomy —The pectoral muscles and weight of the arm bring the shoulder downward, inward, and forward, with overriding of fragments The clavicle is the only bony connection between the chest and shoulder girdle

Problem —To maintain the length of the clavicle by keeping the shoulder up and backward during healing

Healing Period —Four to eight weeks Children under ten heal rapidly

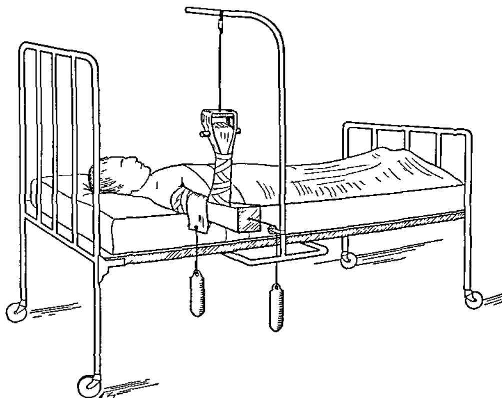


Fig 261 —Side traction apparatus Adaptable to fractures of the clavicle head and neck of humerus shaft of humerus and supracondylar fractures

Methods —1 In children, the figure of eight dressing will usually suffice for the full treatment until union is shown to be present clinically and by x ray examination The dressing is changed for cleanliness only Zinc stearate powder is used to prevent chaffing

2 In adolescents and adults, it is usually preferable to use a Velpeau dressing for ten days to two weeks This can be followed by a figure of eight dressing

3 In obstinate cases, adolescent or adult, especially girls, when perfect alignment is necessary, side traction should be used for three to four weeks and followed by a figure of eight dressing

4 Occasionally when proper alignment cannot be obtained conservatively, an open reduction may be done Wiring with stainless steel or the use of Kirschner wire inserted into the medullary canal can, except for the scar, give perfect results

FRACTURE DISLOCATIONS AND DISLOCATIONS OF THE ACROMIOCLAVICULAR JOINT

These are the result of the same type injury as that causing fracture of the clavicle X ray pictures frequently do not show the extent of the injury

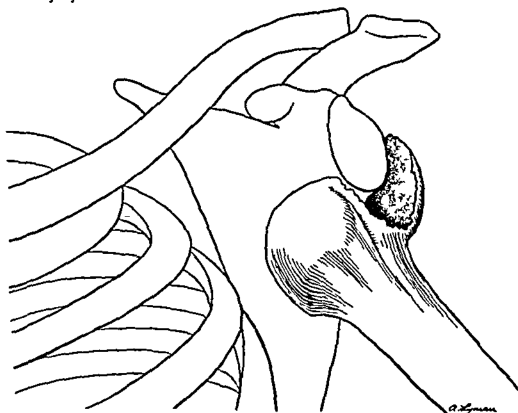


Fig 262 —Fracture dislocation of shoulder Greater tuberosity torn off (sub glenoid type)

Problem —Keep shoulder upward and backward

Treatment —1 Figure of eight bandage with adhesive strapping from chest to back with a pad over the clavicle The use of compound tincture of benzoin aids greatly in preventing skin irritation under adhesive

Change adhesive often so as to prevent skin irritation Immobilization must be maintained long enough to allow complete healing—six to ten weeks

2 Severe cases may require operative repair of the acromioclavicular joint as well as the ligament between the clavicle and the coracoid process

3 In chronic painful dislocations in laborers, the resection of the outer one inch of the end of the clavicle usually leads to relief of symptoms and restoration of function (Mumford) Recovery occurs in about three weeks Metallic fixation by a nail or Kirschner wire may be used in some instances

DISLOCATION OF THE HEAD OF THE HUMERUS

There are several types of dislocation of the head of the humerus, but the most common is a forward and downward displacement

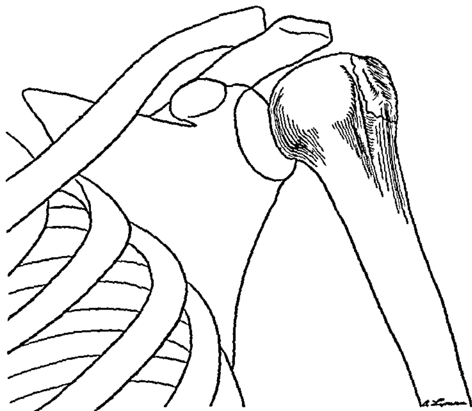


Fig 263 —Dislocation of shoulder reduced Tuberosity has resumed normal position

Cause — Fall on outstretched arm Abduction of the shoulder joint is only possible to 90 degrees At this point, the humerus presses against the acromion process This levers the head of the humerus downward or forward The capsule of the joint is torn either anteriorly or at its attachment to the glenoid fossa The head of the humerus enters the space below the glenoid fossa and rests under the coracoid process

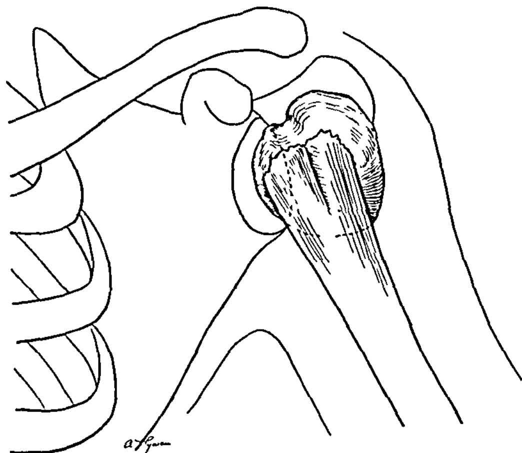


Fig 264 — Fracture of the neck of the humerus showing anterior and upward displacement of the distal fragment The fracture line of the head is angled forward

Symptoms and Signs — Pain The arm cannot now be brought against the side of the body, and there is a depression under the acromion process where the head should be The dislocation may be accompanied by fracture of the tuberosity

Reduction — This should be done under complete anesthesia to prevent further damage to the head and to allow free movement so that the capsules will again close over the head and fall back into its normal position

Problem—It takes about three to four weeks for ligamentous structures to heal However, motion which does not put strain on the healing area in the torn capsule does not retard healing but maintains flexibility

Therefore, the problem with simple dislocations of joints is to start motion within a few days In dislocation of the shoulder, the problem is to keep the elbow constantly forward of the shoulder plane on the affected side If there is a detached fragment from the head it usually falls back into position during the reduction

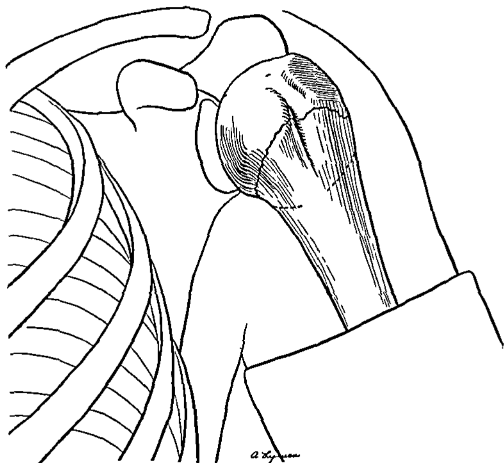


Fig 265—Fracture manipulated under anesthesia and pendulum cast applied Three pounds of lead were incorporated in the cast at the elbow for additional traction neck wrist band

Treatment—Frequently a Velpeau dressing is used for a few days following reduction and then this may be replaced with a neck wrist strap Care should be taken to see that this strap keeps the wrist close to the

chin so that only forward flexion and forward rotation can be accomplished As more complete healing takes place, this distance between the neck and wrist can be increased

When habitual dislocations occur through placing too early strain on the healing capsule or through repeated dislocation, operative repair is needed This may be done by passing the tendon of the long head of the biceps muscle through the head (Nicola), or by suturing the capsule and labium to the anterior inferior lip of the glenoid fossa (Barnhart)

FRACTURES OF THE NECK OF THE HUMERUS

Cause —Usually a fall directly against the shoulder with the arm against the chest or incompletely abducted

Anatomy —The pectoral muscles pull the distal (controllable) fragment inward and forward, and the deltoid pulls it upward They are the strongest muscles of the shoulder girdle group Types (1) transverse, (2) oblique, (3) comminuted

Reduction —In all cases except those without displacement, there should be an immediate attempt to restore perfect anatomical replacement under general anesthesia With the transverse type, this can usually be accomplished In the other types, however, reduction may be difficult or impossible by this means

Problem —Keep the elbow close to the midline of the body so as to relieve the pull of the pectorals Produce some form of traction which will relax the deltoid and thereby prevent overriding and anterior angulation—the two salient factors necessary to reduction

Treatment —In fractures within, or in close proximity to the shoulder joint, early motion is of great importance, and whenever anatomical reposition can be accomplished, motions can be started ten days or two weeks after injury In some instances, however, reductions are difficult to obtain and maintain, and it may be necessary to use a Velpeau dressing for three to four weeks, or a lateral traction apparatus which maintains forward flexion and traction

As soon as 'gluing" of the fracture is present after the most nearly perfect position has been attained, active motion is started This may be in two weeks or it may be in four, depending upon the appearance of the primary and subsequent x ray pictures and the estimated mechanical difficulties

Usually, a cast extending from the axilla to the wrist, with a neck wrist strap, can be applied early The weight of the cast (which can be

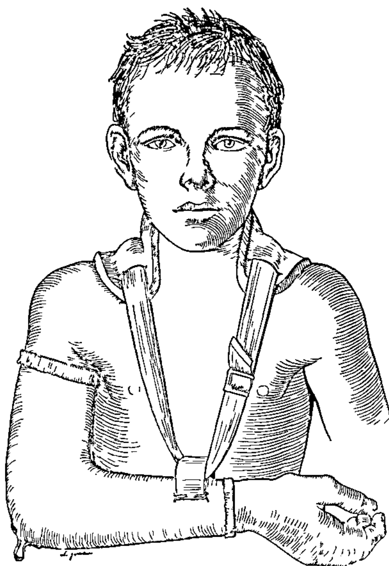


Fig 266—The pendulum method of treatment of fractures in the region of the shoulder or shaft of humerus so called hanging cast Frequently the cast is unessential and efficiency depends on the neck wrist strap combination Loop at elbow for night traction

augmented by sheet lead at the elbow) will give the necessary traction and the neck wrist strap can be adjusted to give the required anterior flexion of the shoulder In this way, early motion without strain in the fractured area may be started

Healing Period —Six to ten weeks

STIFF SHOULDER

In all fractures of the shoulder, arm, elbow, forearm, and wrist, delayed return of function is frequently due to adhesions about the shoulder joint from disuse It is therefore best, with the approval of the surgeon in charge, to start early motion in the shoulder in all fractures of the extremity This should consist of external rotation and forward flexion of the arm two or three times daily

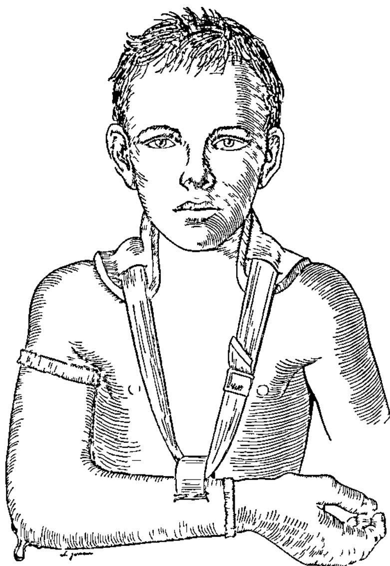


Fig 266—The pendulum method of treatment of fractures in the region of the shoulder or shaft of humerus so called hanging cast Frequently the cast is unessential and efficiency depends on the neck wrist strap combination Loop at elbow for night traction

angle outward due to the combined pull of the biceps and triceps muscles This causes a loss of the carrying angle at the elbow if uncorrected The tendency may be overcome to some extent by applying a cast from the axilla to the fingers with the forearm in a position of extreme and forced pronation (palm down)

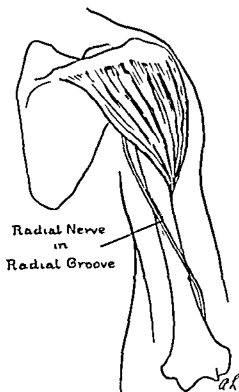


Fig 267 —Showing the proximity of the nerve to the bone with accessibility to injury

Healing Period —*Fractures of the shaft of the humerus may be slow* to heal In about 10 per cent of the cases either delayed union or non union occurs Ordinarily, however, a fracture of the humerus will heal sufficiently for elbow motion in about four to eight weeks Complete recovery may occur in eight to ten weeks In delayed union, it may take as much as three to six months In nonunion, a bone graft operation is usually the most satisfactory way of obtaining union

When patients are in casts, usually little care is required of the nurse, except to watch for complications However, she should attempt, with the consent of the surgeon, to maintain freedom of motion in as many of the neighboring joints as possible by means of massage about the joints and assisted active motions

Chapter 30

FRACTURES OF THE ARM, FOREARM, AND WRIST

FRACTURE OF THE SHAFT OF THE HUMERUS

Cause —(1) Direct violence, such as a blow from the side (2) Indirect violence, such as falling on the outstretched hand

Anatomy —There is usually overriding, especially when the fracture is above the attachment of the deltoid muscle There is also a tendency to outward bowing If the fracture is in the middle third, special observation is indicated at once because of the proximity of the radial nerve to the bone If the radial nerve is injured, it may be in one of three ways, which may be recognized as follows

1 Immediate severance of the nerve—immediate inability to extend (raise) the hand at the wrist Prognosis bad for recovery *without* suture

2 Contusion—as soon as the swelling and edema have reached a sufficient stage, paralysis may gradually occur with drop wrist Prognosis for recovery good with rest

3 Paralysis due to bony overgrowth in healing—gradual development of wrist drop two to three months after injury Prognosis good with removal of bony overgrowth freeing the nerve

Problem —Usually a matter of maintaining traction and a restoration of the best alignment of the fragments There is usually a tendency to outward bowing, which can be overcome either by more traction or by a pad between the elbow and the body

Treatment —This fracture, if transverse, may be treated by immediate reduction under anesthesia, or it may be plated or wired in a few instances Usually a cast from the axilla to the wrist is most satisfactory to the comfort of the patient and adds to the simplicity of treatment in all fractures in the shaft of the humerus A loop of webbing or tape may be incorporated at the elbow so that traction by weights and pulleys may be maintained when the patient is lying down (Griswold) (See Fig 266)

Those fractures which occur a few inches above the elbow must have especial consideration, since there is an especially great tendency to

in medial injury there may be an immediate or delayed loss of sensation in the index and middle fingers Any swelling or edema occurring within the firm capsule of the joint or within the aponeurosis (muscle covering) may cause great tension to be exerted from within This may lead to two things (1) paralysis of the median, ulnar, and radial nerves, causing disturbance of motion and sensation in the forearm and hand, and

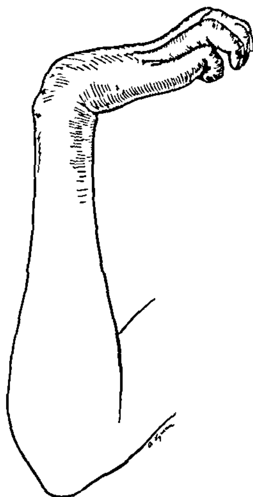


Fig 269 —Well established Volkmann s contracture with clawhand and flexion of wrist and fingers Note atrophy of forearm

(2) extravasation of blood into the fibers of muscle tissue so that they go through a stage of swelling and, later, scar formation (Volkmann's contracture) There is frequently much swelling after fractures and other injuries about the elbow joint, and therefore symptoms of constriction of vessels and injury to muscles may be apparent within four to forty eight hours after injury Cases with injuries about the elbow joint

FRACTURES ABOUT THE ELBOW

This type of fracture is most common in two forms of injury (1) in children who fall with their elbows extended, and (2) in adults where direct violence is exerted against the elbow There may be the impact from a passing car when the elbow is out of the window or there may be a fall on the elbow The type of fall which in an adult would likely cause a dislocation of the elbow due to leverage of the olecranon process *in the olecranon fossa* would in a child cause a supracondylar fracture

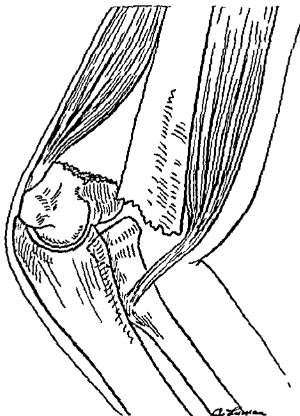


Fig 268 —Supracondylar fracture of the humerus There is posterior displacement of the distal fragments with tension on nerves tendons and vessels The fracture is within the capsule of the elbow joint

Anatomy —The elbow cannot normally extend beyond 180 degrees Forcing beyond this point will cause either a dislocation of the elbow joint or a fracture just above the joint The ulnar nerve runs downward just behind the inner posterior side of the joint and the medial nerve just in front of the joint Either is likely to be damaged at the time of injury or in reduction With ulnar injury, there may be an immediate or a delayed loss of sensation in the little and ring fingers, and

Nerves and tendons are frequently damaged. The repair is tedious and must consist in thorough débridement, suture of nerves and tendons, and restoration of bone and joint alignment. The latter frequently requires internal fixation with wires, screws, or plates. Some, however, after repair may be treated by lateral traction in recumbency.

Treatment.—Supracondylar fractures and dislocations should be reduced under anesthesia. It is usually necessary to place the elbow in a position of flexion to maintain reduction. The amount of flexion must be determined by the ability of the circulation to stand it. In fractures in young children, the flexed position may be necessary only two to three weeks. This is true of dislocations in young and old, but older individuals may need a longer period for complete bone healing. If swelling is severe in cases treated early or if reduction has not been accomplished to a satisfactory degree after seven to fourteen days, lateral traction either through adhesive traction or skeletal traction through the olecranon process should be instituted. In the majority of cases it will be successful provided the surgeon and nurse are vigilant in the application of forces to correct the deformity.

Healing Time.—Motion should be begun in from three to six weeks, depending on the stability at the time of reduction. Complete healing of the fracture takes about eight weeks, but return of complete motion may take three to six months.

FRACTURES OF THE OLECRANON PROCESS

Cause.—Usually due to a direct blow.

Symptoms and Signs.—Pain, swelling, and inability to extend the elbow forcibly. Before swelling has occurred a groove may be felt between the fragments.

Treatment.—Open reduction in all cases which have any perceptible separation of the fragments. This may be done by wiring, it may be nailed, or it may be held in place by a removable beaded screw.

FOREARM FRACTURES

Cause.—Either direct or indirect violence, more usually the latter.

Anatomy.—Pronation and supination are the essential functional motions in the forearm. To preserve these motions following fracture, *the bones must be replaced so that they will be parallel to each other and of equal length.* There must be no obstacle or obstruction between them

should therefore be under hourly observation whether reduced or not for at least forty eight hours During this time, notation by the nurse should be made constantly of any excessive swelling or loss of sensation If such should occur, there should be immediate release of tension by complete freeing of any pressure from the cast, or by incision of the superficial tissues by operation The *fracture should be disregarded* until a circulatory balance is re established

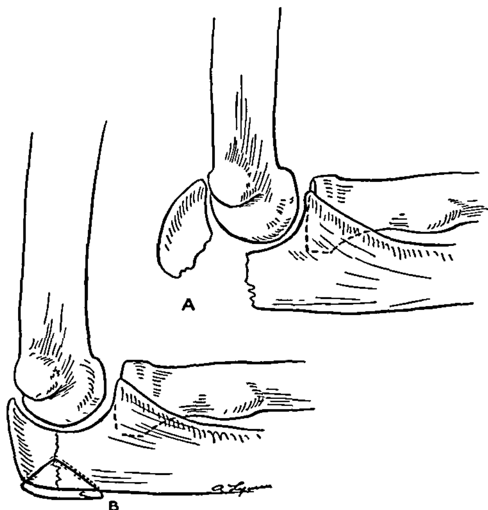


Fig 270—Fracture of the olecranon process which always requires open reduction if the fragments are separated *A* Fracture *B* wire suture which should be fairly superficial for best results

Some of the most severe and complicated fractures the surgeon has to deal with occur in the elbow side swipe injuries They are usually compounded, and the humerus, the ulna, and the radius may be shattered

The width of the interosseous space varies according to the tension or relaxation of the controlling muscles which rotate the forearm from pronation to supination Therefore, when the fracture occurs near the elbow or in the midarm or near the wrist, the governing factor determining the position in which the controllable distal portion of the fractures is placed in relation to the uncontrollable or fixed proximal fragments, depends on the location of muscle attachments and the various tendencies of their pull

In fractures above the pronator radii teres, there is outward rotation of the upper fragment of the radius by the biceps tendon, so the forearm must be placed in outward rotation (supination) In fractures below the pronator radii teres, the forearm must be placed in a position of inward rotation (pronation) to match the muscle action above

The radius, probably due to better blood supply, usually heals faster than the ulna, but nonunion in the bones of the forearm is not uncommon and may require bone graft operations to stimulate bone union Some unreducible cases may be treated by bone plating or the intramedullary nail

Problem —The restoration of rotary motion of the forearm as soon as sufficient union to stand the strain as shown by x ray picture The cast must extend from the fingers up to the shoulder The nearer the fracture is to the wrist, the sooner can the cast be cut to below the elbow Daily full ranges of motion of the shoulder and, as soon as possible, of the elbow should be carried out to prevent adhesions

Healing Time —This varies considerably with the amount of soft tissue damage at the time of the injury and the age of the patient and the individual speed of healing (factors unknown) Solid union cannot be expected (except in children) short of eight to twelve weeks In some cases where there is delayed union, immobilization must be kept up for three to four months This causes considerable delay in the return of motion and function in the joints and muscles

FRACTURE OF THE WRIST (COLLES FRACTURE)

Colles fracture is one of the most common and classical fractures

Cause —Fall, breaking fall with outstretched hand

Anatomy —The far end of the radius is broken off and displaced backward The typical "silver fork" deformity results Muscles play no par

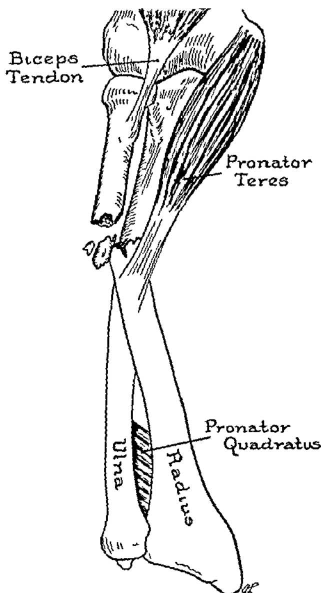


Fig 271 —The anatomy of the muscles of the forearm which influence pronation and supination In fractures above the pronator teres the uncontrollable upper fragment is rotated outward (supinated) In fractures below the pronator the upper fragment is rotated inward (pronated) Fractures are placed in the fixed position to meet the upper fragment accordingly The pronator quadratus always has a tendency to pull both bones together

ticular part except to cause overriding by spasm With the posterior dis placement of the end of the radius, several other things usually occur

1 Shortening of the forearm This tends to make the ulna impinge on the carpal bones

2 Fracture of the styloid process of the ulna

3 Posterior facing of wrist joint, which interfers with action of the flexor tendons

Problem —Reduction may be maintained by the use of

1 The circular cast

2 Anterior and posterior splints which are molded and held in the correct position by bandage—preferably bias flannel or elastic.

3 Commercial splints These as a rule are not dependable, except in a few fractures where fragments are not much displaced and forcible maintenance of corrective position is not necessary

4 In some comminuted fractures, skeletal traction may be essential to good reduction A Kirschner wire may pass through the olecranon and another through the metacarpal bones of the hand These are in corporated in the cast after reduction This method may also be used where both bones of the forearm are broken

Anesthesia —One of several types of anesthesia may be used

1 Local injection of Novocain, 1 to 2 per cent, into the area of hemor rhage within the fracture site

2 Intravenous injection of Pentothal Sodium

3 General anesthesia with gas, gas ether, or ether

In a few cases which reach treatment immediately, reduction may be done without anesthesia because of nature's temporary anesthetizing effect

These methods may be employed in the reduction of all fractures and may be selected according to the condition of the patient The height of blood pressure, senility, and length of anesthesia time must be taken into consideration

Treatment —It is important in reduction that the lines of the deform ity be the determining factor in the application of the traction force The flexed elbow offers a good means of countertraction when a nurse or assistant gets a good grip there Traction on the fingers and hand must be exerted first in the *line of the deformity* When sufficient traction has been obtained to overcome muscle spasm and to free the impacted ser rated bone ends, correction of the deformity will be easy *if the distal* portion is brought into a position which meets the proximal portion of

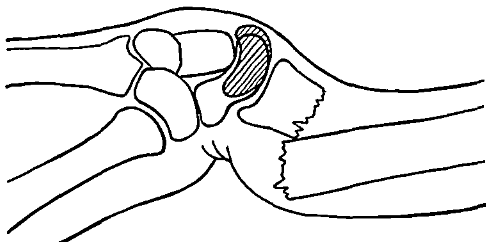


Fig 272 —Colles fracture Lateral view showing overriding and posterior displacement of controllable fragment

RADIUS
ULNA
OS MULTANGULUM MINUS
OS MULTANGULUM MAJUS
STYLOID
OS PISIFORME
OS TRIQUETRUM
SEMI-LUNAR
NAVICULAR
METACARPALS

Fig 273 —Anterior posterior view of Colles fracture showing shortening of radius posterior facing of joint and fracture of styloid process

the fracture It is essential to proper reduction that these three requirements be fulfilled

1 Restoration of the length of the radius
2 Restoration of forward facing of the joint surface of the radius
3 Ulnar deviation of the wrist to restore reposition of styloid process and insured adequate space in the ulnocarpal region

Convalescent treatment combining exercise, heat, massage, and splinting hastens the return of function

ROUTINE TREATMENT FOLLOWING FRACTURES

In all cases, ice bags should be employed in the region of fractures to lessen swelling and relieve pain

As a general principle, cold applications or icecaps should be used in all injuries—fractures and sprains—within the first twenty four or thirty six hours to prevent swelling and edema After this, heat is more soothing

In most cases of bone and tissue injury, aspirin or some form of salicylate is effective for relief of the aching pain Where muscle spasm is present, however, some of the morphine derivatives or Prostigmin may be used fairly freely at first This is particularly true where the injury is associated with shock

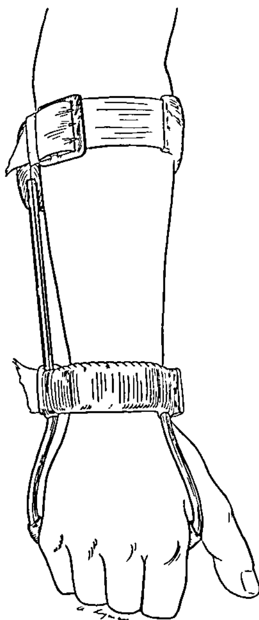


Fig 274 — Three point splint for drop wrist also used for protection of the wrist after fractures of the carpal bones on lower end of the radius Allows free use of fingers and thumb

Reduction —Manipulation under anesthesia is often necessary to re store normal position To maintain this, several methods are used

1 Plaster cast with pressure posteriorly along the shaft and anteriorly on the palmar surface under the "head" (or the metacarpophalangeal joint)

2 Skeletal traction By passing a small pin through the phalanx or by use of the miniature "ice tong" apparatus, sufficient traction may be applied through elastic bands and the banjo splint to maintain proper position of the fragments This is particularly adaptable to the overrid ing oblique or spiral fracture

Check by x ray examination at the "critical" time of about three weeks to see that proper reduction has been maintained

Healing Time —Four to five weeks

FRACTURES OF THE PHALANGES

Fractures of the phalanges comprise two types

1 *Transverse and oblique fractures of the phalanges*

Anatomy —The lumbrical muscles tend to cause palmar angulation of the fragments

Treatment —The problem of reduction as well as treatment is to keep the fingers in flexion until past the 'critical' time This may be done by binding the fingers over a rolled bandage When removed, motion should be re established

2 *Chip fractures of the posterior surface of the distal fragment of the distal phalanx*

Anatomy —Here is attached the tendon of the long extensor Such injury causes an inability to extend the distal phalanx and grave loss of an important function One would be better off with a stiff joint or with an amputation than with this disabling deformity (baseball finger)

Treatment —Complete, exaggerated, and prolonged (four to six weeks) hyperextension of the distal joint of the finger This gives, as a rule, sufficient time for complete reattachment of the tendon and a return of function Suture by operation is occasionally necessary

Chapter 31

FRACTURES IN THE HAND

FRACTURES OF THE CARPAL SCAPHOID

Fracture of the carpal scaphoid, when encountered alone or in combination with dislocations of the wrist, deserves special comment The *disabling possibilities are often underestimated, and treatment is often* insufficient or lacking

Cause —Falling on outstretched hand

Anatomy —The bones of the wrist are peculiar in that the greater part of their surface is covered with articular cartilage This means that the supply of circulation is correspondingly limited An interruption of the circulation by fracture or loss of continuity means starvation to one or another portion of the injured bone with resulting disintegration or *death of bone (aseptic necrosis)*

Diagnosis —By x ray Four views should be taken Sometimes the fracture line does not show up for two or three weeks There is pain and tenderness in the snuffbox "

Treatment —Complete reduction by adequate manipulation is the first requirement Adequate and prolonged immobilization in cast or splint is the next If nonunion should occur, drilling holes through the fracture line or a bone graft may lead to healing, or the removal of one or both of the fragments may improve function and relieve pain

Healing Time —A fracture of the carpal scaphoid requires immobilization in cast or splints for from eight to ten weeks for union to take place

FRACTURES OF THE METACARPALS

Cause —(1) Direct violence or crushing injuries (2) Indirect violence such as striking a blow with the closed fist

Anatomy —Most of the muscle power in the hand is on the palmar surface (interossei and lumbricales muscles) These act *to bow the* metacarpal bones backward in case of fracture

Problem —To immoblize, adequately, in a position that will overcome the tendency to posterior bowing

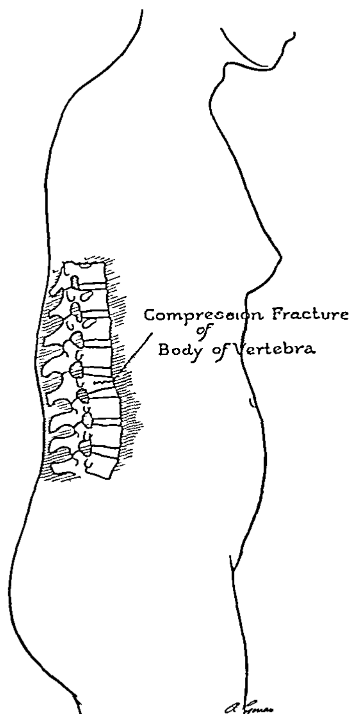


Fig 275 —Compression fracture of the spine Angulation or 'gibbus may occur over the spinous process of fractured vertebra or the one above

Chapter 32

FRACTURES AND DISLOCATIONS OF THE SPINE, HIP, AND PELVIS

FRACTURES OF THE SPINE

Fractures or dislocations of the spine are divided into the following groups in the order of severity

1 Fractures or dislocations with extensive displacement and immediate paralysis of the nerves below the point of fracture

2 Fractures or dislocations with displacement and delayed paralysis below the point of fracture

3 Those with compression of the vertebrae but with no neurological disturbance

4 Fractures of the accessory processes (such as spinous or lateral processes) without any evidence of nerve pressure

Cause —1 Fall in the sitting or stooped position

2 Jackknife type of injury such as occurs when force is exerted against the shoulders and pelvis at the same time

3 Direct blow against back or flank

4 Certain diseases which cause softening or disintegration of the bones of the spine such as hyperparathyroidism and malignant metastases Here the break may occur spontaneously or with minimal strain

First Aid —There is a great lesson to be learned in the treatment of acute injuries which is particularly exemplified in fractures of the spine Usually such injuries occur along the roadside, in athletics, or as the result of falls in construction work or under similar circumstances

The treatment should be started at the scene of occurrence of the injury Obviously the victim of such an accident may have spicules of bone which could result in further damage to the tissues of the spinal cord (See Chapter 37)

Anatomy —The spinal cord is encased in a tube or channel of bone The abnormal position of the vertebra may cause complete shearing severance of the cord at the time of injury, or it may be subjected to damage from spicules of bone or the pressure from surrounding hemorrhage and congestion If severance occurs, paralysis is immediate below the fractured vertebra If the damage results from pressure alone, the paralysis is delayed in its development

Following injuries to the spine, there is almost invariably a shock to the sympathetic nervous system With this comes disturbance of intestinal and bladder activity, and the most serious immediate problem with the patient with spine fracture is often due directly to these factors

The presence of pain often requires morphine sedatives, and this exaggerates internal stasis and sluggishness of bladder muscles to such an extent that enemas and catheterization are frequently necessary for several days Strong cathartics should not be used since they may cause increased discomfort The use of turpentine stupes, hot fomentations, rectal tube, and gastric lavage is advocated An indwelling catheter for five or seven days is occasionally necessary

Treatment —Hyperextension and traction may be accomplished in several ways

1 Bradford frame with gradual increase in the angle within four to fourteen days Check with x rays and follow with body cast

2 Early reduction under anesthesia with the patient suspended by his feet and shoulders, face down Pressure is exerted on the spinous processes at the point of fracture until correction has been obtained X ray examination may be used to confirm the reduction before the cast is applied This should extend from hips to neck to maintain correction The higher the fracture is in the spine, the more difficult it is to maintain the correction It is necessary in fractures above the fifth dorsal vertebra to carry the cast on up to the head and chin

3 Some spine fractures which have healed with persistent pain need internal fixation by some form of bone fusion or graft, or other apparatus to stabilize the spinous processes and laminae in the correct position

4 Fractures or dislocations of the cervical spine are best treated by the use of the Crutchfield tongs These allow weights of from 30 to 40 pounds to be used for reduction

Treatment in the hyperextension cast is usually carried out for from three to six months, according to the severity of the fractures This is followed by a hyperextension brace such as the Taylor back brace for an additional four to six months

Healing Time —The period of healing of vertebrae is from six to twelve months

FRACTURES OF THE SACRUM AND COCCYX

Cause —These fractures are usually caused by direct violence and are very painful Falling on the ice in a sitting position is a common cause

Problem—If paralysis occurs but is not immediate or complete, laminectomy (decompression of the spinal cord) and the removal of bone fragments are sometimes indicated

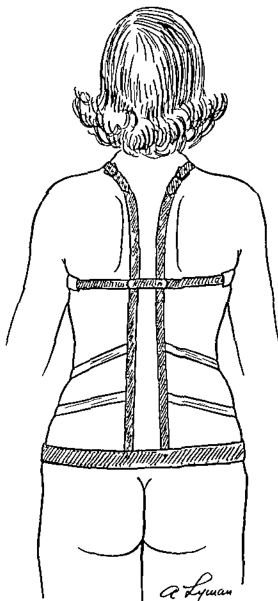


Fig 276—Taylor back brace Used for support of the spine in many conditions such as convalescent fractures and tuberculosis epiphysitis arthritis malignancy round shoulder deformity etc

In complete immediate paralysis, laminectomy has no value

In uncomplicated compression fractures, the problem is to restore the normal contour of the spine by producing hyperextension

injury, to have a great deal of abdominal distress and possibly some difficulty in voiding Sedatives which tend to make elimination more sluggish should be avoided if possible By the injury, the patient has in most cases been forced abruptly from an active to a completely inactive existence and this adds to the digestive difficulties Foods which tend to form gas should be avoided

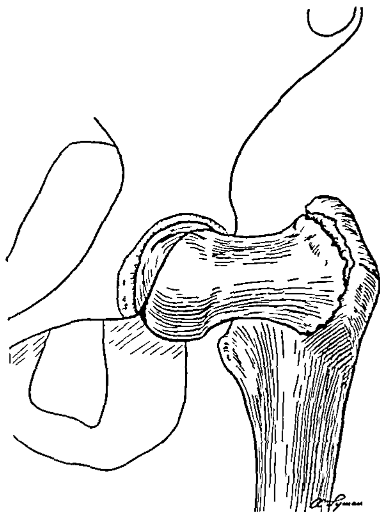


Fig 277—Fracture at base of neck of femur (intertrochanteric type) Note decrease in angle of neck and eversion The lesser trochanter shows up prominently denoting outward rotation

Treatment—Following reduction by traction or by the manipulative method of Leadbetter, the type of treatment must be determined by the proximity of the fracture to the head and the estimated amount of damage to the circulation to the head, and the general condition of the patient

Symptoms—Pain which is aggravated by sitting down or arising Tenderness over the sacrum or sacrococcygeal joint

Treatment—After a period of rest in bed with a rubber ring and much time spent lying prone, low adhesive strapping or a low girdle may be used to relieve muscle pull Sitting on hard surfaces should be avoided Repeated massage of the pyriformis muscles (rectally) often gives relief Occasionally the coccyx may be removed as a last resort

FRACTURES ABOUT THE HIP

Cause—Fractures in the upper end of the femur may be close to the head These are called *intra*capsular If they occur further out in the neck of the femur, they are called *extra*capsular, and if they occur still further out in the region of the trochanters, they are called trochanteric or intertrochanteric To the laity, all of these are 'broken hips" But to the orthopedic surgeon, they are very different in regard to treatment and prognosis

Anatomy—The hip is a ball and socket joint To allow for the free ranges of motion, the capsule which surrounds the joint is quite flexible and extends a considerable distance out along the neck This means that the blood vessels which supply nutrition must enter outside the point of attachment of the capsule Unfortunately, the ligament between the head and the acetabulum (cotyloid ligament) carries little or no circulation to the head Most of the circulation enters the neck of the femur through nutrient foramina and reaches the head inside the bone Fractures of the neck cause a tearing of these vessels, and the head within the capsule may be left with little or no circulation This anatomical fact is the chief cause of the percentage of nonunions which seems to occur in spite of perfect reduction (20 to 25 per cent) This is also the cause of the necrosis and disintegration which may occur in the head of the femur When the fragments have been separated by the injury, the strong gluteus medius muscle pulls the distal portion upward The iliopsoas tends to rotate outward, as does the gluteus maximus Therefore, immediately after the accident, the leg is usually found in the position of "helpless eversion" There are shortening of the extremity and considerable pain and muscle spasm on any attempt to move the patient

Reduction—Reduction is accomplished by applying traction—preferably Russell s traction (Fig 86)—maintaining the alignment of the knee in a neutral plane and the hip in flexion About 10 pounds of weight are used (20 pounds' pull) Reduction u ually takes place automatically in from three to five days During this time, the patient is apt, as in spinal

injury, to have a great deal of abdominal distress and possibly some difficulty in voiding Sedatives which tend to make elimination more sluggish should be avoided if possible By the injury, the patient has in most cases been forced abruptly from an active to a completely inactive existence and this adds to the digestive difficulties Foods which tend to form gas should be avoided

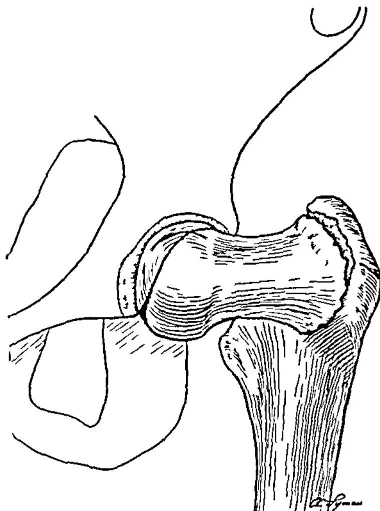


Fig 277 —Fracture at base of neck of femur (intertrochanteric type) Note decrease in angle of neck and eversion The lesser trochanter shows up prominently denoting outward rotation

Treatment —Following reduction by traction or by the manipulative method of Leadbetter, the type of treatment must be determined by the proximity of the fracture to the head and the estimated amount of damage to the circulation to the head, and the general condition of the patient

1 Where there is a fair amount of neck connected with the head fragment, nailing the femur with a three flanged Smith Petersen nail offers many advantages There is a good chance for complete union in from five to eight months

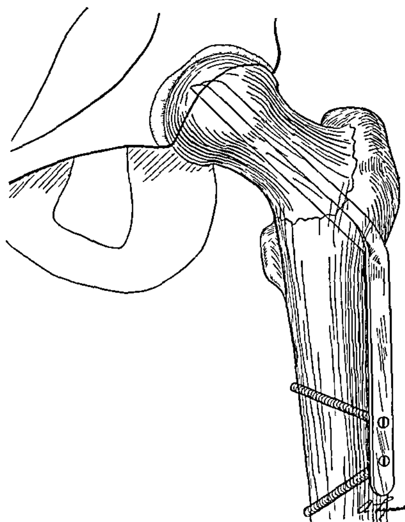


Fig 278 —Open reduction of intertrochanteric fracture with Neufeld nail inserted into neck and head and down shaft of femur with divergent screws The nail is a one piece stainless steel nail with V shaped flanges into the neck and head

After the nailing the patient may be gotten up into a wheel chair for well tolerated intervals on the first or second day In a few weeks, he may be allowed on crutches without weight bearing Weight bearing should not be allowed for from three to five months and then only if x ray examination shows sufficient union

2 When the fracture is very close to the head, or when circulatory damage appears to be severe, it is advisable, if the patient's condition is satisfactory, to treat the fracture by *bone graft* The graft may be taken either from the upper part of the same femur or from either tibia or the bone bank It is passed through a drill hole of appropriate size, through the trochanter, neck, and well into the head In addition to acting as a circulatory stimulus, it also acts as a means of fixation Beaded wires or a Smith Petersen nail may be used for better stabilization, and when used the cast may be avoided Otherwise, following the operation, a plaster of Paris spica is applied from the axilla to the toes Union usually occurs, sufficient for bivalving the cast and exercise, in from ten to twelve weeks But union sufficient for weight bearing does not usually occur sooner than four to six months

3 Intertrochanteric fractures almost invariably heal But with the strong pull of the muscles, they tend to heal with a loss of the normal angulation between the shaft and the neck of the femur This leads to deformity There is shortening, external rotation and adduction

Problem —To avoid deformity, the fracture must be held by an apparatus which will overcome these tendencies until solid union is present Intertrochanteric fractures have been a problem from the standpoint of hospitalization and also of the health of the patient, because a safe amount of union may not occur before ten to twelve weeks, and complete union in four to eight months The treatment of choice has been a long period of immobilization in Russell's traction, or in an adduction hip spica

Recently several types of apparatus for internal fixation have been devised Most notable of these are the Neufeld angled nail, the apparatus of Austin Moore, and the multiple pin technique of Roger Anderson and others When the Neufeld nail or the Smith Petersen nail with the McLaughlin attachment is inserted into the neck of the femur after reduction, the 'handle" is fastened to the shaft of the femur by means of thread cutting screws The patients may be allowed to be in a wheel chair in two to three days and to go through the same routine of convalescence as they do in cases of nailing of fractures of the neck of the femur

EARLY AMBULATION

The early ambulation of postoperative cases as described by Leithauser cannot be entirely adapted to orthopedic cases since his problem is concerned with abdominal operations, whereas ours is concerned chiefly with

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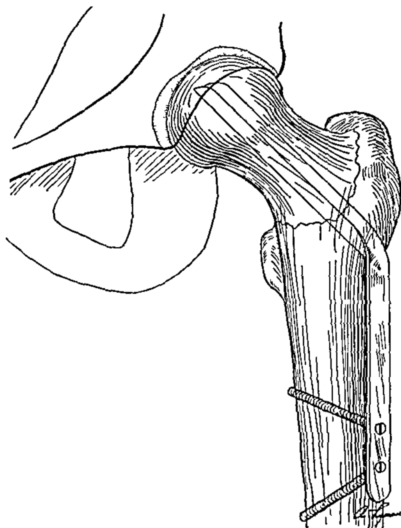


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Cause —Forced abduction of the thigh with the hip in flexion The head of the femur is displaced forward and enters the depression of the obturator foramen There may be damage to the obturative nerve with weakness or paralysis of the adductor muscles

Symptoms and Signs —It is characteristic of the posterior upward dis location that the patient cannot *ab*duct or extend or externally rotate the limb This is in contrast to fractures about the hip joint There is a mass (the head of the femur) palpable on the ilium

With the obturator dislocation, the mass is felt in the groin and the patient is unable to *ab*duct or internally rotate the limb before reduction Both conditions are very painful during the period of dislocation because of muscle spasm

Reduction and Problem Posterior Dislocation —Anesthesia (general) is necessary Reduction can be accomplished by placing the patient on his back, exerting manual traction with the hip in full flexion (surgeon's shoulder under patient's knee) Relaxation is essential If this method fails, the method of Lorenz for congenital dislocations may be successful, that is, extreme flexion and abduction to bring the head into the cotyloid notch, then further abduction combined with decrease in flexion to force the head upward into the acetabulum

Obturator Dislocation —Exertion of forceful traction in the line of deformity, then adduction as the head engages in the acetabulum All reductions of dislocations of the hip are usually accompanied by relaxa tion of the muscles, freedom of movement, and great relief of pain A thud can usually be heard and felt as the head enters the acetabulum One should not be satisfied with the clinical signs but should depend only on checkup x ray pictures taken in two directions

Treatment —Hip dislocations are comparatively easily treated follow ing reduction It is comforting to the patient, because of ligamentous injuries, to have Buck's traction (with about 5 to 10 pounds of weight) for two or three weeks—long enough for ligamentous healing During this time, daily exercises of all joints should be carried out as soon as the patient is able to tolerate them

In fractures of the acetabulum, the same treatment is used, but trac tion should be prolonged for two to three additional weeks A wheel chair, crutches, and gradual weight bearing with crutches (then cane) follows over a period of six to ten weeks

Attention has been drawn to the possibility of permanent damage being done to the head of the femur as the result of ligamentous tearing and disturbance in the blood supply to the head Aseptic necrosis may

conditions involving the extremities (see Fractures About the Hip). Fracture treatment requires a complete immobilization of the part. The general condition of the patient must, of course, be taken into consideration. The mobilization of patients as related to their general health must be of first consideration. The things most feared are (1) atelectasis, (2) embolism, and (3) thrombosis. Most of these can be avoided by early ambulation. This does not necessarily mean getting the patient out of bed immediately after operation but it does mean putting the patient in the most erect position possible after recovery from anesthesia and frequent turning after operation.

The patient does not feel the development of lung complications, and the doctor may be unable to detect râles until there is a cough. The cough may be painful and the patient may resist it but the accumulation of mucus in the bronchi may still be present in the form of increasingly solid masses, and the longer the process goes on the more difficult it is to get rid of the "plugs" by coughing. Often coughing causes pain at the point where he was operated upon and the patient resists the coughing mechanism. *The erect position of the body stimulates the elimination of these bronchial plugs.* Hence, it is important in postoperative cases especially to avoid this serious complication by early institution of the erect position of the body. If standing is possible, it is preferred, but this is not always tolerable to the orthopedic patient, especially if in a hip spica or body cast. In such cases it has often to be supplemented by frequent change of position from back to abdomen and, if therapeutically possible, to the side.

Internal fixation in fractures of the neck of the femur and intertrochanteric fractures of the hip has made it possible to mobilize patients at a very early period. In poor surgical risks the patient may be up in a chair as early as the following day, occasionally the same day. Postoperative deaths have been cut by more than one half and the danger of operation upon the aged has been minimized.

TRAUMATIC DISLOCATIONS OF THE HIP

There are several types, but the ones most common are:

1. *Posterior dislocation with or without fracture of the acetabulum.*

Cause.—Force against the knee with the hip flexed and adducted ("dashboard" dislocations). There may be damage to the sciatic nerve.

2. *Anterior or obturator dislocation.*

Problem —There are two main reasons for restoration of the symmetrical ring of the pelvis

1 To avoid future abnormal strain on the sacroiliac joints
2 To restore the normal birth canal in women

Treatment —Overriding of the fragments may be overcome by the use of Buck's or skeletal traction on the leg of the fractured side Traction automatically causes abduction and pull at the same time, although side traction may also be necessary

When sufficient correction has been obtained through traction, a hip spica of plaster of Paris is applied with the hip in abduction It is usually necessary to apply it only down to the knee

Healing Time —Healing usually takes place in from six to eight weeks Weight bearing on the affected side should be avoided during that time Crutches may be used Patients with this injury are likely to have persistent trouble in the sacroiliac joint It is wise to use some form of pelvic girdle for protection during the early months of weight bearing to prevent permanent damage to the sacroiliac joint

occur if the damage is great Such necrosis may manifest itself after several years by degenerative change in the joint There may be degeneration of the cartilage and partial or complete ankylosis However, patients with dislocations uncomplicated by fracture usually recover in from six to eight weeks without further trouble

FRACTURES OF THE PELVIS

Cause —Fractures of the pelvis usually result from crushing between two forces with considerable violence

Anatomy —The pelvis is a ring composed of the sacrum posteriorly and the ilia on either side and the symphysis pubis in front The weakest spots in this ring are the rami of the pubis Most of the pelvic fractures occur in the rami, but they may occur in the ilia with displacement of the pelvis

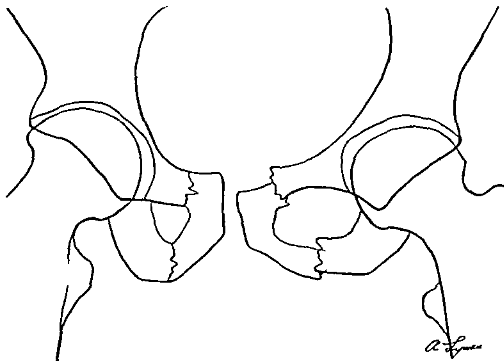


Fig 279 —Fracture of both rami of both sides of the pubis Note the asymmetry of the pelvis Abduction of both thighs is necessary for correction

Complications —At the time of injury, there may be damage to the pelvic organs as a result of the direct force or spicules of bone The urethra is most frequently damaged, the bladder next There may be damage to the rectum If the bladder is full at the time of injury, damage is more likely

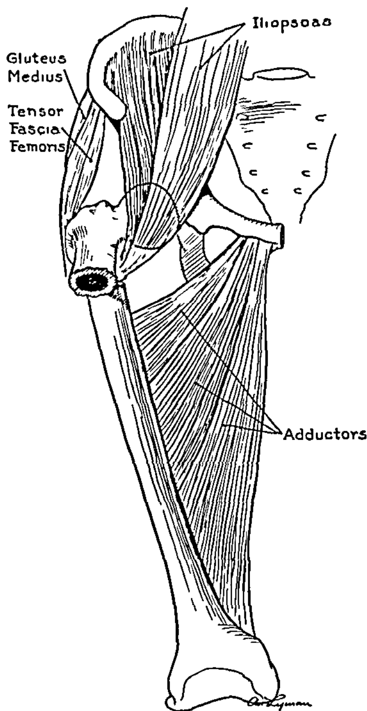


Fig 280 —Muscle action in subtrochanteric fractures of the femur

Chapter 33

FRACTURES OF THE FEMUR

FRACTURE OF THE FEMUR BELOW THE TROCHANTERS

Anatomy—Fracture of the femur below the trochanters is one of the most difficult fractures for successful treatment The fracture occurs above the stabilizing attachment of the adductor muscles so that the upper fragment is controlled entirely by the intrinsic muscles of the hip

1 The proximal fragment is brought into acute flexion by the action of the iliopsoas

2 *It is brought into abduction by the gluteus medius*

3 It is brought into external rotation by both the iliopsoas and the gluteus maximus Consequently it tends to project forward at right angle to the body and to abduct and rotate outward

Problem—The problem here is to bring the *controllable* distal fragment into a position which will meet the position of the *uncontrollable* proximal fragment in flexion at about 80 degrees and abduction and external rotation

Reduction—Reduction can often be accomplished by the Russell traction method But it is necessary to add extra traction under the knee by an independent pulley to increase the usual flexion Ten to fifteen pounds may be required Lateral traction of from 5 to 10 pounds may be necessary to bring the distal fragment outward to engage the proximal fragment If alignment can be obtained and demonstrated in anteroposterior and lateral views by the x ray, good If not, additional changes in the apparatus may be made

However if alignment does not take place this way, some means of internal fixation may be used, either by properly arranged and fixed stainless steel pins or by Vitallium or stainless steel plates, or possibly by intramedullary pins

Healing Time—Healing is slow Solid union does not usually occur in less than ten to twelve weeks We are again frequently confronted with a hospitalization problem Internal fixation does not always obviate the necessity of immobilization but may make the treatment of the fracture a more flexible one in regard to hospitalization and the necessity for bed treatment

3 Plating with slotted stainless steel or Vitallium plates and screws It must be remembered that muscular and mechanical stresses here are great and that it may be necessary to have plates on two sides of the bone, preferably at right angles to each other The screws should penetrate both cortical surfaces of the bone

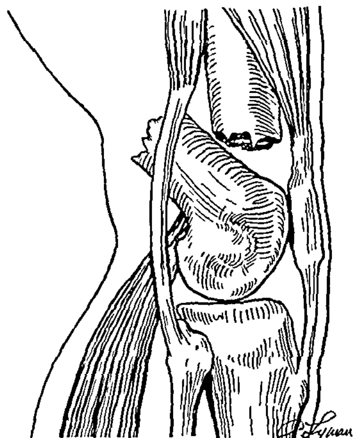


Fig 281 —Supracondylar fracture of the femur (transverse) Note the pull exerted by the gastrocnemius

4 Distraction This is accomplished by inserting pins above and below the fracture in such a manner that reduction is accomplished by a rachet and maintained by incorporating the pins in plaster of Paris or steel bars (Haynes or Stader) so that overriding or angulation may not take place during healing Some pressure contact must always be present to prevent nonunion

It should be remembered that, whatever the method used, the speed of healing is not changed and whatever apparatus is picked by circumstance for the individual case must be kept functioning until complete healing has occurred

FRACTURE OF THE SHAFT OF THE FEMUR (MIDDLE THIRD)

Cause —Direct or indirect violence

Anatomy —Here the action of the gluteus medius still has some tendency to pull the upper fragment outward, and the strong pull of the adductor group tends to cause outward bowing at the point of fracture In this fracture, there is a general tendency to develop an inward rotation of the lower fragment and outward bowing This, if allowed to develop, constitutes an awkward deformity and is quite disabling

Treatment —Some form of traction is required which will maintain pull Russell s usually fulfills the requirements Abduction and external rotation of the distal fragment must be maintained X ray pictures should be taken frequently to check the position If there is anterior or posterior angulation, or if there is inward or outward bowing, the apparatus must be adjusted with proper slings and weights to counteract and correct the tendency to deformity Here again the "critical' period is important before the callus has developed so firmly that it cannot be molded into correct alignment Necessary correction must be done before this state occurs Skin traction obtained by moleskin adhesive or skeletal traction obtained by use of a Kirschner wire or Steinmann pin may be used to secure the desired position of the fragments and to provide for immobilization

Healing Time —In children, femoral shaft fractures heal quickly There is frequently solid union in from three to four weeks In adults solid healing may not take place short of ten to sixteen weeks sufficient to avoid deformities from constant muscle pull The likelihood of deformity must be judged clinically according to the age of the patient, the type of the fracture, and the speed with which the individual produces callus, not only visible in the x ray picture but recognized clinically by its tendency to shrink and solidify

Other satisfactory methods of treatment are those requiring operation Those most commonly employed are

1 Reduction and insertion of an intramedullary nail (Fig 292)

2 Reduction with internotching of the fragments so that they cannot slip off Stainless steel wire may be used to prevent slipping Open reduction is followed by a hip spica extending from the chest to the toes of the affected side with the leg in abduction and external rotation

3 Plating with slotted stainless steel or Vitallium plates and screws It must be remembered that muscular and mechanical stresses here are great and that it may be necessary to have plates on two sides of the bone, preferably at right angles to each other The screws should penetrate both cortical surfaces of the bone

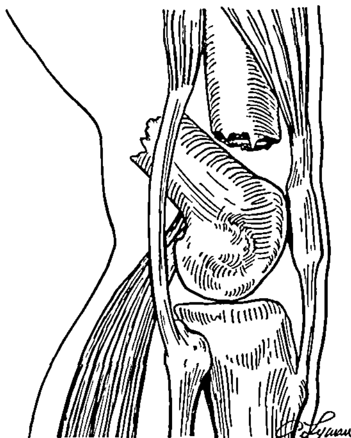


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It should be remembered that, whatever the method used, the speed of healing is not changed and whatever apparatus is picked by circumstance for the individual case must be kept functioning until complete healing has occurred

FRACTURE OF THE LOWER END OF THE FEMUR (SUPRACONDYLAR)

Cause —Direct or indirect violence

Anatomy —This is a distinctive fracture because there is always a tendency to deformity It may be serious and permanent if the mechanical principles are not recognized The gastrocnemius group of muscles is attached above the knee joint and between the condyles of the femur in the popliteal space The only other muscles which influence the position of the lower fragment in this fracture are the thigh muscles which cause overriding Therefore, flexion occurs This varies according to the distance of the fracture above the joint Flexion may approach 90 degrees

Problem —To produce traction on the leg with *flexion of the knee joint* (to release gastrocnemius pull)

Reduction —Usually by means of adhesive or skeletal traction with the knee in a flexed position

If the fracture is of the transverse type, reduction may be accomplished immediately under anesthesia and maintained by a plaster cast with the knee in flexion This is true also of cases in young individuals where there is an epiphyseal separation of the lower femoral epiphysis rather than a fracture

Healing —These fractures heal rather rapidly Complete immobilization is usually necessary only for four to six weeks Physiotherapy is often valuable in restoring free motion in the joint Full development of union and function usually takes place in six to ten weeks

FRACTURES INTO THE KNEE JOINT (FEMORAL CONDYLES)

Cause —Usually direct force either against the inner or the outer side of the knee joint

Anatomy —Such fractures may involve either condyle of the femur or may be of the plateau type involving either of the articular surfaces of the tibia They are characterized by a tendency to produce a knock *knee* (genu valgum) or bowleg (genu varum) deformity of the leg Muscle pull plays very little part in the treatment, but the lateral and internal ligaments of the joint play a considerable part

Problem —To restore the contour of the joint as nearly perfectly as possible and to slightly overcorrect the tendency to deformity Wherever

there is damage within a joint as a result of fracture, the prognosis should be guarded, since the healing process in itself may be the source of irregularities which can lead to future irritation and disturbance of joint function

Reduction —1 In some instances, reduction may be accomplished spontaneously by manipulation with or without anesthesia and the position maintained by a plaster of Paris cast If the fracture is badly comminuted, the cast may have to extend from the waist to the toes Usually, however, it need not extend above the thigh

2 Knee joint fractures do better in traction with adhesive from the knee down Often lateral traction is used to correct any tendency to lateral deformity in the knee This type of treatment has the advantage of allowing active motion of the joint during healing of the fracture but, of course, adds to the hospital days

3 Open reduction is used in severe cases This usually consists in the removal of small fragments which prevent apposition of the main fragments Fixation by the use of nails or threaded wires may be necessary to hold the fragments together during healing

Healing —These fractures usually heal rapidly, but strength and stability are lacking for three or four months Early motion is important in the knee joint, but protection from the development of knock knee or bowleg deformity may have to be given by the use of a long leg brace during the healing period of three to four months

Chapter 34

FRACTURES ABOUT THE KNEE, ANKLE, AND FOOT

FRACTURE OF THE PATELLA

Causes.—(1) Direct violence, usually (2) Muscular action

Types.—(1) Transverse (2) Comminuted (stellate) (3) Linear

Anatomy.—The action of the quadriceps may separate the fragments as much as several inches when the injury occurs It is important to recognize the significance of this in considering the damage to the capsular ligaments of the knee joint The repair of lateral tears should be an important part of the treatment

Treatment.—Only linear, or stellate fractures without separation of the fragments, should be treated conservatively This can be done by immobilization in a cast in extension for three to six weeks

Where there is separation of the fragments with tearing of the capsule, open reduction is always indicated It is preferable in open reduction about joints to delay the operation three to six days to allow the traumatic reaction to subside and to give an opportunity for tissue resistance to develop This lessens the chance for infection Compound fractures may have to be treated immediately

As a rule it is best to remove small fragments of the patella and leave only one main fragment To this the patella or quadriceps tendon is sutured There is no longer a fracture to heal, but only the ligamentous attachments, and therefore immobilization time is greatly reduced When severe comminution with separation occurs, the entire patella is removed, with restoration of good function

ACUTE AND HABITUAL DISLOCATIONS OF THE PATELLA

Cause.—Acute dislocation of the patella is usually caused by direct force against its inner side when the knee is flexed

Habitual dislocation may start from the same mechanism but there may be other factors (1) too shallow a groove in the femoral condyles, (2) ball like shape of patella, (3) knock knee Here the pull trans

mitted from the quadriceps tendon to the attachment of the patella tendon on the tibia is not in a straight line and therefore puts abnormal tension on the ligamentous structure of the inner side of the knee

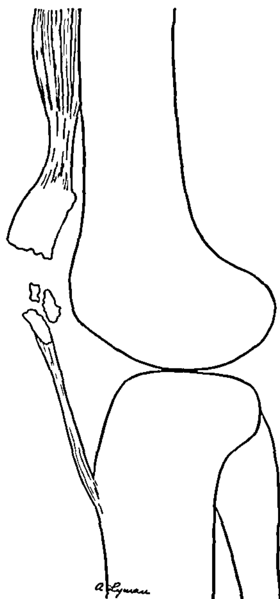


Fig 282 —Fracture of the patella with comminution of the lower fragment This was removed

Symptoms and Signs —The patella can be seen displaced to the outer side of the knee There is severe pain and muscle spasm and the knee cannot be actively extended

Chapter 34

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The test for injury or tearing of the anterior crucial ligament is to force the knee completely straight into extension The anterior ligament becomes tight and *hyperextension* is not possible when the ligament is intact However, if the ligament is torn, the joint may be carried to a position beyond 180 degrees

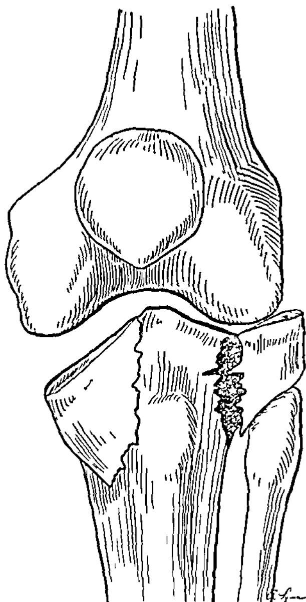


Fig 283 —Fracture of the condyles of the tibia into the knee joint Open reduction done

If the posterior ligament is damaged or torn, or if there is a detachment of the ligament with a small amount of bone from the posterior spine of the tibia, the knee joint, when it is placed in a position of 90

Treatment —Reduction occurs automatically when the knee is extended, but sometimes an anesthetic is necessary to accomplish reduction

Primary dislocations when reduced are immobilized in a well molded plaster cast from the ankle to the groin It is best to keep this on about four weeks After this an elastic support with stays should be worn for two or three weeks longer

In the habitual type some form of operative fixation is necessary The commonest methods are as follows

1 Transference of the patella tendon and its bony attachment inward on the tibia so as to create a direct line pull

2 If the femoral groove is shallow, it may be deepened by osteotomy and wedging

3 Tendon or fascia lata fixation of the patella to the inner condyle of the *tibia*

FRACTURE AND DISLOCATION OF THE TIBIA BELOW THE KNEE (BUMPER" FRACTURE)

Cause —Usually direct violence They are frequently caused by a person stepping in between two cars which are in motion toward each other and are commonly known as "bumper' fractures Sometimes they are compound They usually involve the section immediately below the knee

Anatomy —The tibia is composed of two plates or surfaces which articulate with the two condyles of the femur The knee joint has four important ligaments and two semilunar cartilages The lateral ligaments protect the knee joint from any instability when it is completely straight When extended, both lateral ligaments are tight and prevent any lateral motion of the knee joint

The internal cruciate ligaments are those in the center of the knee joint and are designed to prevent the leg from displacing itself either forward or backward on the femur To acquaint yourself with the direction of these ligaments you may remember the direction of the anterior crucial ligament by placing your right hand, with fingers spread, directly over the right patella when the knee is in flexion The index finger will give you the direction of the anterior crucial ligament which goes from behind forward and is attached to the anterior tibial spine The posterior ligament goes in the opposite direction, that is, from the inner condyle of the femur backward to the posterior spine of the tibia These four ligaments are responsible for the stability of the knee joint in all directions

In some types, hospitalization time may be shortened by the application of a cast in an overcorrected position For example, if the inner condyle is fractured and there is a tendency to the development of bow leg deformity, the cast can be applied in a position of knock knee

If the opposite is the case, then the cast must also be applied from high in the groin to the toes in a slightly exaggerated position of bowleg In either case, the cast should be bivalved at an early period with daily motion of the knee joint Throughout the course of treatment, positive active motion and a slight range of assisted passive motion should be given

Healing Time.—In cancellous bone, such as is found in and near the joint, there is a stage of rapid primary healing, but the stability of the callus so formed is insufficient to stand much strain short of three or four months This allows the early establishment of motion in the joint, but there is not strength enough for early stress, strain, or weight bearing without danger of the development of deformity

Condylar fractures of the tibia may heal within three or four weeks, sufficiently for guarded motion with a split cast Weight bearing on crutches should not be undertaken until the x ray picture shows a fair amount of union

It is desirable at times, particularly when the early weight bearing is necessary, to use a brace which extends from the ischium to the heel of the shoe with a strap on the inner or outer side of the knee joint (dependent on the tendency to deformity), to prevent abnormal strain

From the industrial standpoint, it usually takes from four to six months for patients with this type of fracture to recover sufficiently to return to their normal occupations The amount of permanent disability is variable In many severe fractures, patients may return to their normal occupations without any permanent disability In some, however, whether mild or severe, there may be partial permanent disability and the development of traumatic arthritis

If the ligaments of the knee joint are so badly damaged as to create permanent instability of the joint and interfere with the normal function, it may be necessary to operate, using ligamentous structures, such as tendons, or tensor fascia lata (from the outer side of the thigh) to stabilize the joint The procedure requires hospitalization of a patient for from three to six weeks

FRACTURE OF THE SHAFT OF THE TIBIA

Cause —The causes may be either direct or indirect violence Where there is direct violence, the fracture may be compound A twisting

degree flexion, may be displaced forward on the femoral condyles to the extent of from one half to three fourths of an inch Rotary motions are also increased

The tendency for deformity is toward the collapsed or fractured side of the tibial condyles Should it be the outer condyles, there is a tend ency to the development of a knock knee deformity Should it be the inner condyle, there is a tendency toward the development of a bowleg deformity Both of these are preventable

Problem —1 The maintenance of proper alignment of the leg as compared to the normal leg, and the re establishment of normal joint motion at the earliest possible time

2 Restoration of the most perfect contour of the joint surface

Treatment —In most instances where there are fractures of the upper end of the tibia involving the knee joint, conservative treatment is best

Conservative treatment consists first in the use of moleskin adhesive traction from the knee down, with from 5 to 8 pounds of weight If there is a tendency to knock knee deformity, a sling may be arranged so that lateral traction may be applied at the inner side of the joint, using from 5 to 8 pounds of weight over the outer side of the bed The side traction is flexible, so is the traction in the vertical line, and, therefore, during the process of healing and repair, the patient is able to carry on motions which will greatly facilitate the speed of recovery of joint mo tion As was said before, in all fractures involving any joint, the pa tient or his relatives should be advised of the possible difficulties in re establishing joint motion

In spite of the fact that the knee joint is the heaviest weight bearing joint in the body, the results of fractures into the knee joint are often more favorable than might be expected from the severity of the fracture involving it

It is sometimes necessary, because of the interposition of small frag ments between the main fragments of the condylar fractures of the tibia, to perform an operation in which the area is approached, the frag ments removed, and the condyles brought together in the best possible alignment of the joint surface Occasionally, it may be necessary to employ a threaded bolt which penetrates both condyles and buckles them together by means of nuts properly arranged and properly de signed to exert their pressure The semilunar cartilages which are fre quently mentioned in the literature as a source of trouble in these frac tures seem rarely to be the cause of any serious trouble The scar de veloped during healing usually anchors them sufficiently to assure future stability

Problem —This depends largely on the nature of the fracture—whether transverse, oblique, or comminuted The problem is to reduce the fracture and maintain reduction by the simplest possible means Any deviation in alignment must be avoided

Treatment —Simple transverse and many oblique fractures may be manipulated into position under anesthesia and treated in a long leg cast X ray pictures should be taken at frequent intervals during the first few weeks to see that slipping does not occur If severe swelling should occur shortly after reduction, the cast should be split its full length and spread sufficiently to relieve circulatory embarrassment It can be brought together again after swelling subsides

If fractures of the tibia are difficult to hold in position, they may be treated by intramedullary nailing, by plating, or by skeletal traction In the oblique type two or more screws may maintain reduction by transfixing the fracture site In either case a cast is used for immobilization during the healing period The fixation apparatus is incorporated

When nonunion occurs, bone grafting will usually stimulate union The "onlay full" thickness graft held in place by metal screws seems to be the most popular method (See Compound Fractures, Chapter 35)

POTT S FRACTURE

Cause —(1) A blow against the outer side of the ankle when the foot is in contact with the ground (2) Twisting the ankle when slipping or falling

Anatomy —The ankle joint forms a mortice with the internal and external malleoli acting as stabilizing forces to prevent lateral motion The astragalus acts as a gliding hinge against the lower articular surface of the tibia, allowing only plantar and dorsiflexion movement All lateral movements occur in joints below the ankle joint The classical Pott s fracture frequently called trimalleolar, consists in a fracture of the internal malleolus and of the lower end of the fibula combined with a backward and outward displacement of the astragalus Frequently the posterior lip of the tibia (posterior malleolus) is also broken

Problem —To restore proper alignment and contact of the various fragments by manipulation under anesthesia The ease or difficulty with which this reduction may be done depends on two main factors (1) If the inner malleolus is fractured near the tip rather than at the base of the malleolus, the proximal portion can serve as a barrier against

injury may cause a spiral fracture Fracture of the tibia is one of the most common in automobile accidents, and the percentage of compound fractures is greater than in almost any other region of the body Automobile, industrial, and war fractures are most often caused by direct violence The tibia may be broken by the direct impact of the penetrating force or may be broken in such a way that the points of the fracture penetrate the skin

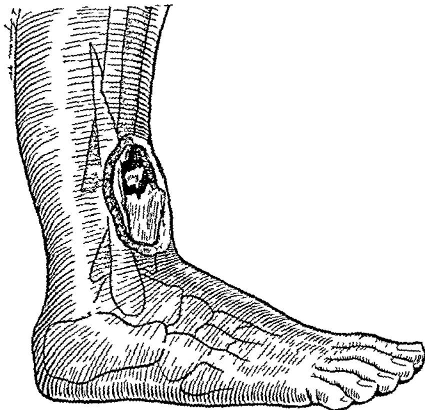


Fig 284 —Compound fracture of the tibia and fibula at junction of middle and lower thirds

Anatomy —The tibia is the main weight bearing bone of the leg It is well covered with muscle tissue in the upper and middle parts, except over the shin, but sparsely covered with subcutaneous tissue and skin in the lower third For this reason circulation is poor and healing is slow Nonunion is relatively frequent in the middle and lower portions The relation of the planes of the knee joint and those of the ankle are important in reduction The injured leg should be compared with the uninjured leg before reduction is attempted so that the proper position in regard to rotation may be obtained

attempted without taking this into consideration during reduction, the internal and external malleoli may not come in close contact at the points of fracture

Treatment —Manipulation into a position which, under fluoroscopic control, gives the closest contact of the fragments This usually consists in forced inversion, dorsiflexion, and lateral pressure through the ankle to restore accurate contact of the internal malleolus with the astragalus and of the external malleolus with the tibia A circular plaster of Paris cast is applied to maintain this position and *must* extend from the toes well up on the thigh with the knee moderately flexed so as to maintain the corrective amount of rotation Where the fracture line of the internal malleolus is at the same level of the joint surface or above it, fixation of the internal malleolus by nailing may be necessary

Healing Time —Usually from eight to twelve weeks As a rule, the portion of the cast above the knee may be removed at the end of eight weeks and frequently the lower portion may be bivalved for daily motion at the same time

When the fracture is of the favorable type, weight bearing, with the use of a walking iron or similar device incorporated into the cast, may be begun as early as four to six weeks There may be some permanent disability due to traumatic arthritis in the ankle joint

FRACTURE OF THE ASTRAGALUS

Cause —Usually indirect violence, such as landing on the foot in a fall

Anatomy —The astragalus articulates with several bones, and a large portion of its surface is covered by articular cartilage The area in which the blood supply may reach it is therefore small In many instances, fractures will damage the blood supply to such an extent that healing is delayed Disintegration of the bone through aseptic necrosis is not infrequent, or there may be nonunion

Treatment —Perfect reduction of the fracture is essential *To maintain* reduction, nailing or bone graft may be required Occasionally removal of the astragalus is indicated

Immobilization in a plaster of Paris cast is advocated The ankle should be placed in a right angle position so that the best function, if ankylosis should occur will ensue

Healing Time —Healing is slow and weight bearing cannot be allowed until union is shown by x ray However, the cast may be bivalved in

overcorrecting the fracture inwardly (2) If the fracture of the posterior malleolus involves as much as one third or one half of the posterior surface of the tibial part of the joint, the difficulty in maintaining the forward reduction of the dislocation is very great and some form of open fixation is usually necessary

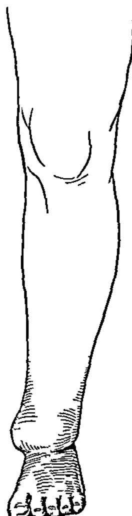


Fig 285 —Pott s fracture showing posterior and outward displacement of ankle joint Ordinary joint contours disappear

Reduction —In addition to an accurate interpretation of the x ray pictures of Pott s fracture, a comparison between the fractured and unfractured sides should be made In some individuals the ankle joint and the knee joint work in the same plane, whereas in others the ankle joint may be relatively outwardly or inwardly rotated If reduction is

The rule in many clinics is If the pain persists beyond the six months' period, the accumulation of bone under the external malleolus should be removed and the substragaloid joint, possibly others, ankylosed by operation

FRACTURES OF THE METATARSAL BONES AND TOES

Cause —Usually by direct violence

Anatomy —The metatarsal heads comprise the anterior arch and one of the main weight bearing surfaces of the foot The muscles and tissues here are sparse Therefore, restoration of length and alignment, particularly in the anteroposterior plane, are the main problems of reduction and treatment, since a prominence of bone on either the plantar or dorsal surface of the foot could lead to irritation from weight bearing or shoes The treatment following the necessary amount of reduction is usually the application of a plaster of Paris cast from the calf to the end of the toes Skeletal traction may occasionally be necessary

Healing Time —These bones usually heal in about four weeks Following the removal of the cast, protection must be maintained for several weeks by the use of an arch support within the shoe and a metatarsal bar on the outside

six to eight weeks and some motion, heat, and massage started for the restoration of joint function When the cast is discarded, the arch should be supported for weight bearing Total healing may not occur sooner than ten to fourteen weeks

FRACTURE OF THE OS CALCIS (CALCANEUS)

Cause —*Direct violence, usually from falls, the victim landing on the* heels Frequently bilateral It may be associated with compression fractures of the spine They are common in explosions on shipboard

Anatomy —The os calcis (or calcaneus) is composed almost entirely of spongy bone When the outer surface is broken, the inherent strength of the bone is lost

Displacements which occur from the injury are usually in three directions Lateral squashing shoves the fragments out under the external malleolus and tends to cause a flatfoot deformity Upward displacement of the posterior portion tends to exaggerate the flatfoot tendency This is increased by the pull of the tendo achillis Outward rotation also occurs

In the usual anteroposterior and lateral x ray pictures of the foot and ankle, the true degree of displacement is not shown This has led to disastrous undertreatment of these fractures Because of their disabling effect, they are usually much more formidable than they appear Therefore x ray pictures should be taken from behind the leg at a 45 degree angle so that a true picture of the lateral displacement and outward rotation of the fragments will be shown The foot for this view is in complete contact with the x ray plate

Treatment —*There are several methods of treatment, but the* essential factor of all is that the bone be restored to as near its normal shape as possible This requires lateral impaction of the fragments and downward displacement of the heel The latter can be accomplished through lengthening of the tendo achillis and downward replacement through leverage in skeletal traction The arch must be restored and all corrections maintained by the proper application of a plaster of Paris cast

Healing Time —Weight bearing cannot *be allowed short of six to* eight weeks and then only with the arch well supported to prevent weight being exerted on the os calcis The degree of permanent disability is usually determined (1) by the extent of involvement of the subastragaloid joint (2) by the amount of residual lateral displacement under the external malleolus and against the peroneal tendons, and (3) by the residual flattening of the longitudinal arch

be determined in others The knowledge of this fact may decide the ultimate recovery or loss of function in a limb or limbs This is also true in compound fractures Written records of what has been found and done should accompany each patient to the hospital or surgeon

5 There is considerable debate at present as to the advisability of using a tourniquet, since the prolonged use may lead to death of the tissues in the extremities beyond its point of application In compound fractures it is preferable to use a piece of sterile or clean bandage or string to tie off the bleeding vessel if it is exposed, or to apply local pressure to the vessel by means of a pad of sterile gauze and a sterile bandage If a tourniquet has to be used in cases of violent bleeding, it should be removed about every twenty to thirty minutes and the bleeding observed If coagulation has occurred in the vessel the tourniquet may be left loosened, but there should be constant observation for return of bleeding

Undoubtedly "refrigeration anesthesia" will play an important part in the future transportation and treatment of compound fractures The temperature is maintained, either by ice packs or by electrical refrigeration, at about 40 degrees Bleeding is controlled as well as pain, and bacterial action is inhibited during transportation, even though it might take many hours

6 Emergency immobilization and transportation

a Spine or head The recumbent position is essential If a rigid stretcher such as a plank, a door, a ladder or two poles and a blanket cannot be obtained, it is advisable to roll the patient horizontally onto his face and transport him in the arms of two or three persons to a truck or the back seat of a car He should never be brought into a position which will flex the spine

b Clavicle, ribs, shoulder, and elbow Splinting can best be done by bandaging the arm to the side of the chest This may be done with any materials obtainable—a torn sheet, a shirt, or other clothing Two triangular slings work well if obtainable

In fractures about the elbow and forearm, one or two wooden splints from the axilla to the finger tips may be tied to the arm with handkerchiefs or strips of clothing

c Hip, thigh, knee, and leg These may be immobilized by narrow boards placed on either side of the leg and held together by a bandage or strips of clothing When the hip is injured, the splinting should extend from the heel up to the side of the chest, and the bandages should encircle the chest and leg All injuries of the bone should, if possible,

Chapter 35

COMPOUND FRACTURES AND FIRST AID

INTRODUCTION

If a portion of *the* bone *has* penetrated through the skin and *has* become contaminated by contact with the ground or any other contaminated material, it is a great mistake for the person who might be called upon to render first aid to pull this fracture into place and thereby pull contaminated substance inside the wound The limb should be splinted as it is

The general practitioner in the small town is frequently not equipped to do major bone surgery such as the debridement and reduction of compound fractures The time element is usually an important one, since in cases of general catastrophy operating teams in centralized areas may be so overloaded with work that delay is inevitable in certain cases The wound through which a bone has penetrated is frequently a clean wound, since no contaminated object has entered The situation is entirely different when there is a *penetrating* wound with the bones exposed

FIRST AID IN FRACTURES

There are a few simple rules which apply to first aid in fractures

1 Keep the patient at rest in a horizontal position as long as he is unconscious or until the extent of his injury can be determined

2 If he must be transported while still unconscious, continue the horizontal position until consciousness is regained sufficiently for the injured to signify points of pain and tenderness

3 In case of back injury, every precaution should be taken to avoid motions of the spine, particularly such as would occur if the person were brought into a sitting position, since this may lead to damage of the spinal cord by fragments of bone protruding into it or pressing upon it

4 Where there is injury to the spine or to the limbs, it is of particular importance that the surgeon know definitely whether or not any paralysis was present immediately following the injury This cannot be determined in the unconscious patient who has a head injury but can

be determined in others The knowledge of this fact may decide the ultimate recovery or loss of function in a limb or limbs This is also true in compound fractures Written records of what has been found and done should accompany each patient to the hospital or surgeon

5 There is considerable debate at present as to the advisability of using a tourniquet, since the prolonged use may lead to death of the tissues in the extremities beyond its point of application In compound fractures it is preferable to use a piece of sterile or clean bandage or string to tie off the bleeding vessel if it is exposed, or to apply local pressure to the vessel by means of a pad of sterile gauze and a sterile bandage If a tourniquet has to be used in cases of violent bleeding, it should be removed about every twenty to thirty minutes and the bleeding observed If coagulation has occurred in the vessel the tourniquet may be left loosened, but there should be constant observation for return of bleeding

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In fractures about the elbow and forearm, one or two wooden splints from the axilla to the finger tips may be tied to the arm with handkerchiefs or strips of clothing

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be immobilized so as to include the joint above and below the injury If no splinting material is available, fairly adequate immobilization can be obtained by tying the injured leg to the uninjured one with a series of bandages from the thigh to the foot

d Fractures of the ankle The most satisfactory temporary splint here and in the lower leg is the pillow bandage The limb is laid longitudinally on a pillow so that the heel is just above the edge The lateral edges of the pillow are then brought together over the limb and pinned When the ankle is reached, the lower ends of the pillow are crossed under the foot, brought upward and pinned so that a compact splinting effect is obtained In all splinting of fractures the bony prominences should be protected by cotton batting if obtainable or by any soft material

e The Thomas splint for the leg and the Jones splint for the arm are easily applied and give good immobilization for transportation They are carried by almost all first aid stations and ambulances either civil or martial

f Shock is due to a disturbance in the vasomotor system which allows relaxation in the peripheral circulatory system, thereby decreasing the amount of blood returning to the heart The heart pumps from an empty system and is unable to fulfill the requirements for blood exchange to itself and other parts of the body Shock may be due to hemorrhage or to a complete temporary disarrangement of the nervous system as a result of the injury Fear may be an element in its production It may be fatal The blood pressure is greatly lowered and the pulse is rapid and weak The skin becomes pale and the injured person may become listless or even unconscious If hemorrhage is the cause, it should be stopped as promptly as possible and fluid should be administered in replacement Stimulants such as coffee or tea may be used Morphine and its derivatives tend to restore the balance between the peripheral and central circulations Complete rest must be given in a recumbent position As soon as infusions and blood or plasma transfusions are available, they should be given immediately Shock is usually from movement at the point of fracture and from hemorrhage rather than from malposition

In first aid, any contaminated compound fracture should be dressed and splinted in the exact position in which it was found so that proper precautions can be taken when the patient reaches a hospital or other point where he can receive adequate surgical attention Some writers

contend that since a thorough debridement is necessary in any compound fracture, the additional amount of contamination occurring when the bones are pulled into line when first seen does not materially increase the chances for infection of the compound wound. This contention is doubtful.

It is preferable that a clean dressing or handkerchief or sheet be applied at the site of injury and that the limb be splinted in the position of the existing deformity. The use of strong irritating antiseptics such as iodine, Lysol, or carbolic acid is contraindicated. Alcohol, Mercurochrome, Mercresin, or Scott's solution may be used with little chance of local damage or coagulation of the tissues.

If the patient is in shock, all primary attention should be paid to this. Intravenous saline infusions, transfusions, or blood plasma may be necessary.

To prepare a compound wound for operation, quantities of soap and water should be used. A brush or sponge will help the effectiveness of this. Benzine is used to dissolve greasy materials. The skin and wound are then painted with a noncoagulating antiseptic and draping is applied. The wound is flushed clean with several quarts of saline solution under low pressure. This is done with an elevated bottle and a glass nozzle on the end of rubber tubing. All loose, bruised or contaminated portions of tissue are then removed with knife or scissors. Bone should be preserved if possible.

The antibiotic drugs have aided very greatly in lessening the fight against infection. They are placed directly into the wound after the cleansing and debridement. In addition, a specific antibiotic is given by mouth or intramuscularly over a period of three to seven days following the injury. They have served to lessen the occurrence of infection tremendously. Units 1,500 of tetanus antitoxin and 5,000 to 10 000 of gas antitoxin should be given subcutaneously.

REDUCTION

The reduction of compound fractures may require internal fixation. The past few years a great deal has been learned about internal fixation. One of the major troubles has been due to the electrolytic effect of metals placed within the bone or tissue. This, by an electrical or electrolytic effect of the body fluids on the metal, caused a destructive process and in turn a degeneration of body tissue including bone. The area surrounding such metal became liquefied and absorbed. Hence the

be immobilized so as to include the joint above and below the injury If no splinting material is available, fairly adequate immobilization can be obtained by *tying the injured leg to the uninjured one with a series* of bandages from the thigh to the foot

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the ward, including shaving, scrubbing with soap and water, and the application of an antiseptic Skin disinfectants which "burn" the skin cause considerable postoperative irritation and itching under the cast

The draping of the bone surgery patient on the operating table is of extreme importance It must be remembered that frequently during operation the limbs have to be moved and manipulated through great ranges of motion Draping must be arranged so that no dressing can be displaced during these manipulations

It is advisable, in case a limb is being prepared for bone surgery, that the entire limb be surgically prepared and that special attention be given to the preparation of an area at least ten or twelve inches above and below the site of operation It is preferable that two or three layers of large sterile sheets be placed under the limb and that rolled towels encircle the limb immediately above and below the site of operation This decreases the chance of contamination Several pairs of towels should be fixed to the skin with towel clips, outlining the immediate area of incision

Following the debridement and cleansing of compound wounds, the instillation of an antibiotic seems to have been an effective aid in guarding against infection However, *this should not be considered a substitute but merely an adjunct to adequate debridement* There are some statistics which seem to prove that x ray treatments two or three times a day following severe compound fractures which have occurred under bad conditions have avoided or decreased the incidence of gas bacillus infection This, however, does not eliminate the necessity for giving both tetanus antitoxin and gas bacillus antitoxin as prophylactics in all compound fractures Immobilization following open reduction of compound fractures is a very essential part in the avoidance of infection and other complications All compound fractures which arrive at the hospital for treatment within six hours after injury are considered clean and are treated by *debridement,* flushing with quantities of sterile saline solution, instillation of an antibiotic, reduction, closure, and the application of a cast

Compound fractures occurring longer than six hours before admission are considered primarily infected in spite of the most careful debridement and other precautions, including antitoxins In these cases, drainage is instituted and, if necessary, because of pain and elevation of temperature for a twenty four to forty eight hour period, the cast should be bivalved, or a window made and the wound inspected Otherwise the open wound is left undressed within the cast

screws which were inserted to hold plates of fixation loosened and the plates were no longer effective In addition, the plates caused areas of absorption in the vicinity This tended to prevent the healing of fractures Frequently it was necessary that many of these plates which were made of nickel plated copper (a most active electrolytic agent), had to be removed because of ineffectiveness or nonunion

It has been found both experimentally and in practical work that Vitallium has no appreciable electrolytic action Such plates and screws placed on and inserted into bone show no local destructive effect on the bone and have frequently been left in place for years without any loss of strength or absorption of bone in their vicinity This is also true of stainless steel, and from experiments of J Albert Key, of St Louis, there is reason to believe that this metal has possibly less irritating effect on bone tissue and creates less local absorption about the screws than Vitallium

These facts have led to a fairly common use of internal fixation for the treatment of fractures of the long bones (clavicle, humerus, radius, ulna, femur, and tibia), which could not be satisfactorily treated otherwise Internal fixation is secured with plates and screws or by means of an intramedullary nail

Clay Ray Murray of the Presbyterian Hospital in New York and others bring out an important point in use of internal fixation They state with reasonable assurance that if one is to use internal fixation as a means of immobilization, the fixation should be adequate to allow weight bearing without other immobilization This requires that fracture fixation in the long bones consist not only in one sided plating, considered by many sufficient, but additional plating, either in a parallel or right angle plane, in order to secure complete internal immobilization The plates should have slots instead of holes so that pressure between the bone ends can be preserved

Such treatment, when carried out under the commonly accepted standard of bone surgery technique, entails comparatively little danger of infection It must be remembered, however, that the technique in bone and joint surgery must approach the closest to perfection of any form of surgery

In elective bone surgery not only must the patient be in the proper condition physically and prepared before and after the operation for any possible surgical shock, but the limb which is being operated upon must be in a state of perfect asepsis before the operating room is entered This requires arduous and exacting preparation of the limb on

In many instances, surgical procedures can be greatly shortened and the patient relieved of much surgical shock by the use of the bone bank The same is true of the "skin bank" It is feasible, of course, that the banks may be greatly augmented by the use of bone removed at autopsy from suitable cases

Many operations such as spinal fusion and bone grafts can be made much shorter and safer under the bone bank regime Many plastic operations are possible with less shock and danger to the patient with the "skin bank" The principle is simple—removal, deep freeze, preservation, defrosting, and use

Ribs are by far the most readily available type of bone for the bank, because of the Smithwick operation, but from time to time an amputated limb may be sawed up under sterile conditions to augment the bone bank All specimens are labeled, filed, and catalogued Cultures are taken at the time of removal and at intervals thereafter under the same sterile conditions

The odor of gas infection is characteristically sweet and pungent In addition, air bubbles may be seen exuding from the wound The presence of air in the tissue may also be demonstrated in the x ray picture The pulse is rapid, the temperature variable This may call for intensive x ray treatment and further administration of gas antitoxin The removal of the cast may be necessary The fracture is now of secondary importance Multiple incisions into the tissues for adequate air penetration and drainage may be needed

EMBOLI

Occasionally in compound fractures or in simple fractures where clotting has taken place in a vein, a portion of the clot may break off and be carried throughout the circulation to various parts of the body Air emboli also occur If an embolus lands in a vital organ, such as the lung heart, or brain, there may be disastrous consequences, even death

The patient usually develops a rapid pulse and evidences of shock which comes on abruptly Death may occur within a few minutes from the onset of symptoms, or within a few hours Treatment, other than preventive by adequate immobilization, is of no avail Those patients having emboli in the less vital areas may have the symptoms and signs in a milder degree and yet recover The emboli are more frequently pulmonary than any other type and may occur as late as six to eight weeks following the injury

BONE BANK

Everyone is familiar with the blood bank The bone bank has become a very important and valuable asset to the orthopedic and plastic surgeons The skin bank also plays an important role in all branches of surgery

They work on the same principle Bone from amputations, where malignancy or infection is not involved, bone from osteotomies, rib resections, or any other source may be placed in a sterilized fruit jar in a deep freezer and kept for many weeks It can be used when needed, after immediate defrosting, for bone graft fusions and the like, as long as the blood type is the same as that of the recipient

It is necessary, therefore, that correct records be kept on the donor and the recipient The whole process is very simple as long as the requirements are kept in mind

child or adult should recognize the great danger and threat to balance which a round rolling object, like a marble or pencil, presents to the unwary walker They should be taught to remove them from floor or sidewalk whenever they are observed

Small scatter rugs can be very treacherous They must be well anchored to prevent slipping This may be done by rug fasteners or by the use of rubber floor mats Scatter rugs should never be placed either at the top or bottom of stairs

To assist in preventing some of the hundreds of bathroom accidents which take place each year, a rubber mat in the tub is advisable A railing on the wall near the tub will give more confidence and provide safety for the elderly person taking a tub bath

Another common cause of home accidents is standing on rocking chairs or on old frail kitchen chairs in order to reach high shelves or to put up curtains A small, firm ladder should be available for all such household jobs

If the household includes an elderly person who must get up at night to go to the toilet, it is important that a clear, unobstructed lane be left between his bed and the bathroom An easily available bedlight will also discourage nocturnal journeys in the dark which are fraught with so much hazard for the elderly person

These are only a few of the more obvious pitfalls for the individual in the home The alert and observing nurse will be quick to notice others Most of these items seem of small importance, but it is from just this background that many severe fractures originate

NURSING CARE OF THE PATIENT WITH A FRACTURED HIP

Since fracture of the upper end or neck of the femur, the hip fracture as it is commonly called, presents more nursing problems than any other type of femoral fracture, emphasis will be placed on the nursing care required for this condition Fracture of the femur at other levels will not vary greatly from this

The methods of reduction and of maintaining reduction are still complex and various The patient may be placed in a hip spica or well leg cast, he may be placed in one of a half dozen types of suspension traction, or he may be treated surgically by internal fixation If he is obviously moribund, treatment may be palliative, with simple traction of

Chapter 36

NURSING CARE OF THE FRACTURE PATIENT

THE NURSE'S ROLE IN PREVENTING FRACTURES

It would be illogical to outline ways in which the nurse may assist in preventing such conditions as tuberculosis, infantile paralysis, and back strain, and to omit emphasizing her part in the prevention of fractures Her role as health teacher demands that she recognize some of the commonest causes of accidents, particularly in the home, and methods by which they may be eliminated

Accidents in the home are almost as important as motor accidents, both in incidence and severity Studies have shown that the greatest number of injuries come from falls, indeed, falls are responsible for almost one half of all home injuries

Since falls play a large part in the etiology of fractures, the home hazards which have frequently been the cause of falls should be recognized by nurses The report given by the subcommittee mentioned above emphasized particularly the dangers having to do with stairs Many grave accidents take place yearly in the course of going up and down stairs Waxed stairs, and waxed landings at the top or bottom of stairs, are always dangerous The waxing process of any floor surface should be carefully done, as oo much wax or too little polishing tends to make floors slippery On stairs, floor wax may be particularly treacherous

Stairs should be provided with handrails, if none are available, the householder should be urged to stretch a cord or rope along the stairs at a suitable level, adequately supported by firm uprights In homes where young children are living, gates at the top of stair flights are essential to prevent falls

Steps should never be cluttered with stray objects, as cellar stairs, for instance, are so likely to be They should be kept clear for traffic, and all members of the family, young and old alike, should recognize that running down steps is distinctly hazardous All stairs which lead outside should be covered with coarse salt or sand during seasons of icy weather

Children and adults should be alert for such objects as marbles, clothes pins, pencils, and toys left about on stairs, landings, and floors Any

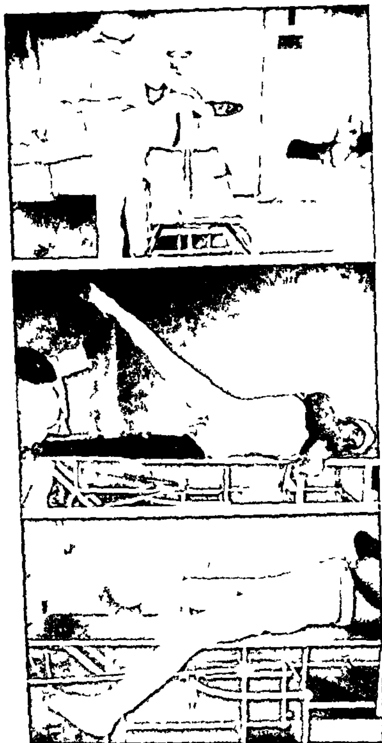


Fig 286 —Casts used in fracture of the femur showing abduction internal rotation and slight extension of the limb sometimes called the Whitman cast, or the method of external fixation in fracture of the femur (From Key and Conwell Fractures Dislocations and Sprains The C V Mosby Company)

from 10 to 15 pounds applied merely to relieve the pain and muscle spasm and to enable him to be moved in bed without too much discomfort

Probably the most common method of treatment in the past was the method of Whitman It is sometimes spoken of as the method of external fixation, in contrast to later methods of internal fixation In this *treatment, a double hip spica cast was used, extending from the nipple* line to the toes on the affected side, and usually to the knee on the unaffected side Since the care of cast patients is taken up in detail in another chapter, it will not be repeated here, except to emphasize the necessity for sealing cast edges so that plaster crumbs are not allowed to get down inside the cast Raw cast edges are extremely hazardous for the skin of elderly patients

The Whitman cast made frequent turning of the patient possible and the ever present danger of congestion of the lungs was obviated somewhat by conscientious care It was possible in some cases to get the patient on his feet with crutches soon after reduction

Nursing Care in Internal Fixation

Internal fixation apparatus—the Smith Petersen flanged nail, the Neufeld nail, the Jewett nail, or the Austin Moore pins, to mention only a few—has become the accepted method of treating hip fractures Nursing problems after such procedures are greatly simplified The operation itself is not considered a serious threat unless the patient is in very poor physical condition However, the complications of old age—kidney dysfunction, cardiac impairment, hypostatic pneumonia—make any operation somewhat of a hazard in the aged, and this should not be *lost sight of in any method of treatment*

Aftertreatment where internal fixation is used may vary considerably Buck's extension may be applied for a brief period, or some type of suspension traction in combination with a Thomas ring splint The patient is usually given much latitude in regard to movement in bed As early as the first postoperative evening the patient may be turned for back care, and, if turning is done toward the extremity operated upon, the bed supplies a type of splint and the patient will be fairly comfortable There is no danger to bone fragments involved in moving about in bed, for fixation is complete Such traction as is employed is usually a temporary measure for overcoming muscle spasm and making the patient more comfortable

Postoperatively, if there are no contraindications and the patient has not been placed in traction, the surgeon usually requests that these elderly patients be up in a chair the morning following surgery. There is no weight bearing on the affected extremity, the patient being lifted or assisted to the chair. This procedure alone does much to prevent postoperative pneumonia.

Many physicians instruct the patient to begin knee movement the day following fixation of the hip. The patient is turned to the side of the fractured extremity so that the knee may be flexed while the hip is kept in the extended position. There may be muscle spasm in the muscles of the thigh, particularly in the quadriceps, when this is first attempted. Nurses should seek complete instructions from the surgeon regarding this treatment and the rate of progress expected.

If secondary deformities are to be prevented, good body alignment must not be forgotten. Many of these patients seem to be more comfortable with the extremity supported by a pillow, with the hip and knee flexed, and the leg in external rotation. This pillow must be removed at frequent intervals, and the patient encouraged to flex and extend the knee. Some provision should be made to prevent foot drop and external rotation of the foot during the patient's days in bed. A bedroom slipper with a thin strip of wood, one inch by eight inches, nailed to the heel will effectively prevent outward rotation of the leg.

Care and Prevention of Complications

Pneumonia.—A high percentage of the patients with fractured hips are elderly, the problems involved in this type of nursing are geriatric as well as surgical in nature. Many complications of advanced age may be present, including cardiovascular disease, renal dysfunction, diabetes, and obesity. Hypostatic pneumonia is always a threat if these patients are put to bed even for short periods. We are told that one half of the deaths that occur following fracture of the femur in the elderly are brought about by pneumonia. For this reason, prophylactic antibiotic therapy is sometimes instituted after fractures and continued for a week or longer. Frequent turning, elevation of the head of the bed, protection from drafts, and solicitude in keeping the patient well covered during bathing and turning are essential nursing measures. This patient should be encouraged to breathe deeply and to cough up mucus. Frequent observation must be made to detect evidences of beginning cyanosis and dyspnea. Another common cause of death after fracture of the femur in the elderly is thrombophlebitis. As a prophylactic measure against

To turn a patient after a recent fixation, when he is somewhat apprehensive about being moved, it is usually preferable to stand on the side of the fractured hip and place the hands on the opposite hip and shoulder by reaching across the patient He may then be gently turned onto the fractured extremity and toward the nurse Segmental bending should be avoided When the patient is turned on the unaffected leg the fractured limb should be kept at the same level as the trunk this



Fig 287 —Smith Petersen flanged nail used for internal fixation of fractures of the neck of the femur

can be accomplished by the use of pillows which may be placed between the legs before the turning process is begun Carelessness in supporting the limb will be a source of considerable discomfort to the patient If the patient desires further support as he turns, he may steady himself by placing his upper hand on the nurse s shoulder If the fractured leg is suspended in a sling or splint, after internal fixation, the patient is usually turned on the good leg, and firm pillows are used to support the leg in the suspension after the patient is turned

to see that it contains the necessary food elements Sufficient vitamin and protein intake is particularly important To build tissue resistance and hasten repair, protein supplements may be given Protein hydrolysates and amino acid mixtures are procurable for this purpose when the patient is unable to eat sufficient foods containing these substances Vitamins B and C are also considered important in fracture healing If these patients are unable to take sufficient diet by mouth, supplementary feedings containing the essential proteins and vitamins may be given in a formula, through a polyethylene tube The polyethylene tube is a small plastic tube, which is inserted through the nostril into the stomach This tube is taped to the nose and left in place

It must be remembered, also, that anything at all which affects the patient s general condition will be likely to affect the healing of his fracture Age, of course, plays a large part in the rate at which a fracture will heal A fracture of the femur in a very young baby will heal firmly in four weeks, while in an individual of fifty or more, the time required may be three or four months or longer As has been stated, deficiency diseases, cachexia, and senile osteoporosis will definitely retard the rate of bone union Blood chemistry determinations are ordered by the physician when the progress of healing is slow Serum calcium of 10 to 12 mg per 100 c c of blood, and phosphorus concentration of 3 5 to 4 mg are considered normal Milk and a calcium medication are sometimes ordered, or a parathyroid solution and synthetic vitamin D Vitamin D is usually considered not to be effective unless a sufficient intake of phosphorus containing foods is given

Urological Complications —Elderly patients are particularly prone to develop urological complications during a period of immobilization This is sometimes due to unwillingness to take sufficient fluids and to an already existing renal impairment Scantiness of output, discomfort on voiding, concentrated urine, suppression, incontinence, or edema should be reported to the physician at once Intake and output should be estimated daily on elderly patients with fracture of the femur until it has been ascertained that kidney function is normal

All patients, whether young or old, are in danger of developing renal stones if they are extensively immoblized for a considerable period of time This is true whether the immobilizing apparatus is a cast or traction, or merely continuous bed rest Intelligent nursing care can play an important part in diminishing this danger A large fluid output is essential to overcome renal stasis and to insure a steady flow of urine An acid ash diet, high in vitamins A and B, will serve to improve epithelial nutrition and to increase urine acidity These things will of course

this, Dicumarol may be given ten to fourteen days after the fracture if the patient is being kept at bed rest

Prevention of Decubiti —Daily bathing and maintaining a clean dry bed are essential, if pressure areas are to be prevented If the patient is very old, if evidences of chronic malnutrition are present, or if there is circulatory impairment due to arteriosclerosis, the fight to prevent pressure areas must be particularly vigilant It must be started the moment the patient enters the hospital Patients of this type are not usually placed in apparatus which will make turning them too difficult, and the responsibility for seeing that decubiti do not develop is squarely up to the nurse Where circulatory impairment is present, it is an extremely difficult problem Nothing, of course, will be as beneficial as frequent changes of position This means that the patient must be turned every two hours or even more often Rubber rings must be used with caution, as a too highly inflated ring sometimes serves to cut off circulation in the buttock area An air or water mattress may be useful in preventing excessive pressure at any one point of the body Airfoam sponge rubber under threatened areas has proved very helpful in preventing pressure sores on the sacrum and heels, and unclipped sheepskin is also excellent for this purpose The sheepskin should be washed frequently with a mild soap and water, rinsed carefully, and dried in the sun to keep it soft and pliable

Gastrointestional Disturbances —Obstinate constipation is almost invariably present in these patients The management of this feature can be extremely troublesome if too frequent use of strong carthartics has been made during the early course of immobilization Distention is not infrequent, and rectal tubes and hot foments or stupes may sometimes be necessary to overcome this Careful attention to the patient's diet for roughage, and vitamins, and elimination of foods which cause distress will do much to overcome constipation Enemas may have to be used occasionally and mineral oil may be ordered as needed Attention to regularity is, of course, essential

Nutritional Problems —A large number of these patients will have eating problems They have no teeth and are unable to see or hear well They have definite food likes and dislikes, and it is difficult for them to understand our hospital routines and methods The thoughtful nurse can do much to make mealtime a pleasant occasion for these older patients

Since the rate of repair in fractures has been shown to be greatly influenced by deficiency diseases and malnutrition, which are so often present in elderly patients, considerable thought must be given to the diet

more likely to cooperate with her and less likely to feel neglected when he is urged to care for his own wants as far as it is possible for him to do so. Many physicians order a series of gentle bed exercises to be carried out under the nurse's direction several times during the day to prevent loss of muscle tone, and to prepare the patient for successful ambulation at as early a date as possible.

Preparation for Weight Bearing

The amount of time the patient will be kept without weight bearing varies according to the progress of union. It may be from twelve to sixteen weeks or longer. As has been stated, bed exercises are frequently prescribed. These may be muscle setting exercises for the abdominal, gluteal, and quadriceps muscles, dorsiflexion and inversion exercises for the feet, and rhythmic breathing exercises. Exercises to strengthen the arms and shoulder muscles are usually added before the patient is ready to ambulate, to prepare these muscles for crutch walking. But since the period of inactivity is long, considerable encouragement may be necessary to motivate the patient to continue the exercises over the period he is nonambulatory. Explanation of the importance of these exercises may need to be repeated at frequent intervals.

Even though exercises are faithfully carried out, there is still a tremendous hill for the patient to climb. Unexpected weaknesses and stiffness of many parts of the body which were not involved in the fracture may be present. These will alarm and depress the patient if he is not forewarned of them. For instance, it is not uncommon to have the patient complain that his knee feels worse than the hip that was fractured. This may be a source of great concern to him, and nurses should take the opportunity to teach the patient something about the mechanics of the quadriceps muscle and its action on the knee and hip in walking.

If the nurse can help the patient understand that his weaknesses and the stiffness in his joints are the natural outcome of his fracture and inactivity, and not a permanent sequel to it, she will do much to bolster his failing courage. She must be very careful not to do anything which will make him more apprehensive. Sudden jarring of the bed, for instance, will be enough to undermine his confidence considerably. Any rough or hurried movement while carrying out the prescribed exercise for increasing motion in hip or knee or any enthusiastic increase in the range of motion beyond which the patient has previously gone will also be conducive to much loss of courage. Furthermore, acute muscle spasm around the hip will make it impossible to do anything further in the way

be ordered by the physician, but the nurse will need to see to it that the patient is encouraged to take the diet in which these elements are included, not always an easy task, since the appetite is often very sluggish Furthermore, the patient must be moved frequently and with sufficient variation in bed or chair posture so that no part of the urinary tract is left undrained for too long a time

In addition to these measures, some type of chemotherapy may be ordered to combat the development of stones The regime described is usually continued for as long as three months after the patient is ambulatory, and x ray every three to four months thereafter may be ordered Any symptoms of pain or distress referable to the urinary tract should be reported at once Renal stones may occur as early as one month after recumbency

Mental Aspects in the Nursing Care of the Patient With a Fractured Hip—Frequently the older patient with a fractured hip becomes disoriented The pain and shock suffered, plus being in a strange environment, is just enough to cause mental confusion This confusion may not be apparent in the daytime, but at night the patient will attempt to get out of bed, and his talk will be incoherent The nurse must realize that this may be expected and that she should provide side rails or other protection for her patient

Elderly patients with fracture of the hip rarely escape serious mental depression The prospect of inactivity is in itself a heavy burden to bear, and when accompanied by financial worry—as it almost always is—it is extremely difficult to prevent attitudes of depression and melancholy Furthermore, these patients frequently have a pessimistic outlook as regards their own recovery The nurse caring for them needs to develop considerable understanding and sympathy for their problems She will be confronted by sessions of tears and hopelessness not once but periodically during the time the patient is inactive Good mental hygiene demands that the patient be given something to do, and constructive occupational therapy is almost indispensable in caring for these patients Although the trained occupational therapist is highly desirable for assisting with the daily program of the fracture patient, the bedside nurse can do a great deal in urging him to do as much as he can for himself, even though he is confined to a chair It is not always easy to secure cooperation in this, because considerable apathy and indifference may exist But if the nurse makes it clear to the patient that her desire to have him do things for himself stems from her interest in his progress, he will be much

frequently during the day, with gradual increase of the time spent in the sitting position The patient may be instructed to lift the chest, to practice breathing exercises and to contract the gluteal and abdominal muscles after he has become used to sitting The almost universal tendency of the elderly patient is to sit on the side of the bed with shoulders sagging, chin on chest, and head and shoulders drooped Unless efforts are made to overcome this at the outset, this type of posture may become permanent



Fig 288 —Assisting the bed patient to a sitting position The patient is turned to her side with hips and knees flexed The nurse places one arm beneath the patient s shoulders and the other one under the knees She stands close to the bed with one foot forward knees and hips flexed slightly, and trunk in good alignment Note that in this picture to show the position of the patient the nurse has stepped to one side

To assist the patient to the standing position, and thus into a chair, the nurse should place her hands under the axillae and allow the patient to place his hands firmly on her shoulders In this way he is assured of adequate support for his first standing experience The chair should be parallel to the bed, and the patient is gently guided toward it by the

of mobilization at that time *Support should be placed under the lumbar spine, the knee and at the foot and the limb should not be allowed to lie in outward rotation*

Helping the Patient to Be Ambulatory

Physical therapy treatments, given by a trained therapist, can do a great deal at this time to make the ordeal easier for the patient Heat, special types of massage and exercise will aid in promoting normal circulation in the injured limb and will hasten absorption of traumatic exudate In addition, pain and discomfort are lessened through releasing of the protective muscle spasm around the joint, and joint function necessary for walking is re established If such treatments must be given by the nurse, they should first be demonstrated by the physician, and every detail of the treatment clearly pointed out

When the order has been given for the patient to sit on the side of the bed preparatory to being up, he should first roll onto the side of the sound leg When this has been accomplished, the knee and hip of the good leg should be flexed to a right angle, approximating the position of the body in sitting If the patient is able partially to flex the hip and knee of the affected side, this should be done, but it must be remembered that this leg will require the most gentle handling at all times, and that the joints should never be forced beyond the point of pain Some physicians prescribe an elastic bandage to be applied to the injured extremity before the patient is allowed to sit, to give support to prevent the troublesome edema and mottling which occur when the extremity becomes dependent

To bring the patient to the sitting position, the nurse places one arm under the patient s shoulder and the other arm under the knees, gently swiveling the patient to the sitting position If the fractured leg is extremely sensitive, another nurse may need to be on hand to support it

The nurse should check her own body mechanics carefully for this procedure, being sure to assume the foot forward position, with knees and hips flexed and back straight Considerable strain and torsion may be put on her back if she encounters resistance from the patient, and she should be prepared for this before beginning the procedure

The patient is pivoted, or swiveled, to the sitting position slowly at first in order to prevent faintness When the sitting position has been obtained, the nurse should continue to support the patient s back until he is steady The initial period of dangling is usually very short, and the patient is then returned to the side lying position which he assumed before coming to the upright This dangling procedure may be ordered

will be greatly increased once he has accomplished this The chair must be steady, propped against the bed or wall The patient is instructed to bend forward from the hips, to place the unaffected leg backward until an acute angle of the knee is formed, and to have the knee on the affected side flexed as much as possible, the foot flat on the floor The patient places his hands on the seat of the chair with the elbows slightly flexed to assist in elevating himself Weight is taken entirely by the normal foot as the patient comes to the erect position If the crutches are near at hand, the patient can steady himself with one hand on the back of the chair as he reaches for the crutches with the other Care is to be taken that no weight is borne on the injured leg



Fig 291 —Hip prosthesis When aseptic necrosis of the head of the femur occurs following fracture of the neck of the femur, the prosthesis may be inserted thus making weight bearing possible

Instruction in crutch walking for the elderly patient is usually delayed until partial weight bearing can be permitted Then the three point gait is taught This delay in crutch walking is necessary since the danger of falling and of bearing weight on the affected extremity is too great

It is necessary that provision be made for adequate follow up care of the patient with a fractured hip Early detection of loss of position, nonunion, or aseptic necrosis makes it possible to institute corrective measures When nonunion persists after adequate reduction the surgeon may wish to insert a tibial bone graft in the freshened nail tract, or when

nurse, who turns him in such fashion that his back is toward the chair seat If he is very weak, the nurse should flex her knees and hips sufficiently to allow the patient to retain his hold on her shoulders until he is safely seated in the chair

Later the patient can be taught to come to a standing position from the chair without too much difficulty, and his confidence in his ability



Fig 289



Fig 290

Fig 289 —When assisting the elderly patient from the bed to a chair it is important for the nurse to know whether there is to be any weight bearing on the affected extremity If no weight bearing is permitted it is best not to use a footstool but to have the patient slide off the bed in the manner illustrated taking weight on the good extremity The Hi Low bed which can be raised and lowered is very helpful in getting orthopedic patients in and out of bed

Fig 290 —The chair is placed parallel with the bed After the patient has gained her balance in the standing position she pivots on her good extremity and is in position to sit in the chair Note that the nurse has a firm grip on her patient and is in a position to support a great deal of the patient s weight without strain to her own back

Where there is no separation of the fragments, the patient may be placed on a hard bed or Bradford frame, with Buck's extension applied to the legs. Unless orders are specifically given to turn the patient, back care is given by elevating the patient either with the aid of an overhead trapeze or with the assistance of another nurse.

Scultetus or abdominal binders are sometimes used instead of hammocks, particularly if there has been no involvement of the acetabulum. The binder should extend from the iliac crest to two or three inches below the pubis. If the binder is made of canvas, it is wise to insert a lining of silence cloth or other soft material between the skin and the binder. Instructions given for application of the binder in different types of pelvic fractures are usually as follows: (1) for fracture of the iliac bone, the binder is applied without snugness. (2) For fracture of the ischium or pubic bones, it is applied snugly. (3) If there is separation of the symphysis pubis, the binder is applied as tightly as possible.

FRACTURES OF THE FEMUR

Use of Traction in Fracture of the Femur.—Traction and suspension are frequently used for treatment of fracture of the femur at different levels. Russell traction is probably the most widely used method, but skin and skeletal traction with a Thomas, Hodgen, or Keller Blake splint are also in common usage. Care of the patient in traction has been discussed in a previous section of the book, but it should be emphasized here that when traction of any kind is employed for the reduction of fracture in the aged person, the likelihood of pressure areas is even greater than in the Whitman cast method. The use of the back rest to prevent pulmonary congestion means that much of the body weight is borne on the buttocks and sacrum, necessitating frequent massage of those areas. An overhead trapeze will make it possible for the patient to lift himself for back care and the bedpan.

It has sometimes been considered a perplexing problem to provide for a back rest when boards are used between mattress and springs as they are on orthopedic wards. Hinged full length boards, so constructed that the hinge coincides with the back rest elevation of the bed, are now available in many hospitals.

Since there is evidence that a high incidence of kidney stones occurs following long periods in traction, nurses should do everything in their power to eliminate this danger. Patients in traction should have a high

aseptic necrosis has taken place, he may wish to replace the head of the femur with a Vitallium prosthesis The ball part of the prosthesis fits into the acetabulum Some studies of this last surgical procedure have been encouraging, others report that in some instances there is bone absorption resulting in loosening of the prosthesis and loss of functional results Following insertion of a prosthesis, the patient is placed in balanced suspension traction or a hip spica cast for a period of seven to ten days During this time good nursing care is of the utmost importance if complications so common to the elderly patient are to be prevented Following removal of the traction or cast, crutch walking (three point gait) with partial weight bearing is instituted, and the individual is encouraged to resume normal activity as nearly as possible

FRACTURES OF THE PELVIS

Nursing Care —Under this classification are fractures of the ilium, pubic bone, sacroiliac, and acetabulum They are of varying degrees of severity, but in all the nurse should be aware of the danger of internal injuries, particularly to the bladder, urethra, or rectum A specimen of urine is usually ordered immediately by catheterization, and a soft rubber catheter should be used in this—never one made of metal A rectal examination is also done by the physician to rule out injury to the lower bowel

The most common fracture of the pelvis is that occurring in the pubic bone, and it is often caused by a compression between two solid objects or a fall in which the patient lands on the hip

After reduction of a fracture of this nature, the patient may be placed in a canvas sling attached to an overhead frame Buck's extension is usually applied to the leg of the injured side Compression of the pelvis is obtained by fastening the ends of the canvas sling together over the front of the patient If compression is not desired, the canvas sling may have wooden spreaders at either side and be supported by separate ropes and pulleys on the overhead frame The hammock should be about five feet in length and two feet wide It should extend from the upper border of the lumbar vertebrae to midthigh Just enough weight to keep the pelvis off the mattress is used, and for nursing care the hammock may be pushed or folded back over the buttocks This type of hammock sling accomplishes lateral compression on the sides of the pelvis, forcing the separated pubis together at the symphysis It is usually continued for about six weeks

Where there is no separation of the fragments, the patient may be placed on a hard bed or Bradford frame, with Buck's extension applied to the legs Unless orders are specifically given to turn the patient, back care is given by elevating the patient either with the aid of an overhead trapeze or with the assistance of another nurse

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fluid intake and as much postural variation as is possible without disturbing the apparatus Frequent urinalyses for patients in traction are usually considered advisable

Treatment by Means of the Well Leg Splint —The Roger Anderson well leg splint is very frequently used in treatment of subtrochanteric fractures of the femur, particularly in the elderly patient One section of this splint is applied to the good leg by means of a plaster cast which



Fig 292 —Treatment of fracture of the femur by means of the intramedullary nail Following reduction of the fracture the nail is driven down through the shaft of the femur across the fracture site This type of internal fixation permits increased activity and earlier ambulation

extends above the knee A Kirschner wire or Steinmann pin is placed at the distal end of the tibia on the affected side, and a plaster cast is applied extending to the knee The remaining section of the splint is then attached to the Kirschner wire (or Steinmann pin) The apparatus is so constructed that screw adjustments make it possible to push the well leg upward while traction downward is made on the affected leg

This pressure and pull are exerted on the pelvis causing the well leg to be adducted and the injured leg abducted

Textbooks on fractures claim that this method of treatment makes nursing care very simple, but as a rule nurses consider this statement a questionable assumption The undeniable advantage, however, is that this type of treatment enables the patient to sit up in bed or in a chair very quickly after the injury, thereby minimizing the danger of lung congestion The patient may also be turned from side to side, permitting adequate drainage of the urinary system The long immobilization of the knee joints tends to cause stiffness in the knees, but muscle tone can partly be maintained by quadriceps setting exercises Pressure on the medial aspect of the leg may sometimes cause thrombosis of the vessels in that area, and nurses should be alert for symptoms indicating this complication

FRACTURES OF THE BONES OF THE ARM

Nursing Care —Fractures occurring through the neck or upper third of the humerus which are reduced by traction offer some perplexing problems to the nurse For such traction the bed must have a firm hard mattress, and some method of countertraction must be devised Usually elevating the bed by shock blocks under the head and foot of the affected side will provide sufficient countertraction, although occasionally some type of restraint jacket secured to the unaffected side may be necessary also The traction is applied in two parts, with the arm flexed Two adhesive straps which extend out to a board and pulley extending from the side of the bed are used for the upper arm Another set of adhesive straps is applied to the forearm and attached to a spreader which is out a considerable distance from the ends of the fingers From this spreader a rope extends to an overhead pulley and thence to weights Some type of padded handle, suspended from this spreader, is useful, inasmuch as it enables the patient to flex his fingers and hands over it Extension on the forearm is used to eliminate its dependent weight as well as to relax muscle spasm in the upper arm

Though the rest of the patient s body is unencumbered, he is usually not permitted to turn, and for that reason considerable discomfort in the upper back and shoulders may occur Frequent alcohol rubs for these areas will be of use in eliminating this Changing of the under sheet must be done with great dexterousness to prevent movement of the patient's body and disturbance of the traction As pressure points tend to

form rather easily around the bony prominences of the wrist, this area should be inspected frequently.

Complications of Fractures of the Bones of the Arm.—Fractures above the condyles of the humerus—the "elbow fracture" of common parlance—are very common in active youngsters. Such patients do not often remain long in the hospital. They are frequently brought in for reduction, and dismissed in a few hours. It is quite essential that in this case the parents be warned of the danger of circulatory impairment from subsequent swelling, and they should be told how to detect such a complication. They must understand that the fracture itself should not occasion very excruciating discomfort for the child, and that continued crying or repeated complaints may indicate that there is an obstruction in circulation. Not long ago a small boy with such a fracture was taken to his home five miles out of town after reduction of a supracondylar fracture which had been done in the hospital outpatient department. The child complained bitterly for twenty four hours before the parents realized this was not the normal sequence of events after a fracture. When he was brought back, a fully developed ischemic contracture, of the kind described by and named for Volkmann, had occurred, and ten months of constant treatment were necessary to bring back even a partial use of the hand.

Coldness, pallor, and cyanosis of fingers may be the first indication that there is circulatory impairment. Swelling and pain often follow rapidly, and some paresthesia may be detected on touching the digits. Since all fractures are accompanied by some degree of swelling, observation should be constant and vigilant in these cases. Too often this may be neglected because the patient seems to need relatively little nursing care and, for the most part, looks after his own wants.

A good test for circulation is the so called blanching sign, which determines patency of blood flow. The nail of the thumb is momentarily compressed, and the return of blood to the nail is observed. If the return is immediate, circulation is thought to be adequate. Sluggishness in the return of the blood to the part is indicative of some degree of impairment and should be reported to the physician. One authority warns in huge letters in his textbook on fractures: WATCH THE HAND FOR *SWELLING AND BLUENESS OF THE NAILS.* CAUTION ALL CONCERNED THAT IF THIS OCCURS THE FIXATION APPARATUS SHOULD BE REMOVED AND THE ARM BROUGHT INTO EXTENSION. THE FRACTURE CAN

ALWAYS BE REDUCED THE SECOND TIME BUT A VOLKMANN'S CONTRACTURE IS A PERMANENT DISABILITY"* Surgeons make it a rule to disregard the fracture in any circulatory emergency

Elevation of the arm by pillows or by suspending the arm in an overhead sling may sometimes reduce the swelling considerably However, with the first evidence that circulation is not normal, the nurse needs to be on guard No excuse can possibly be made for delay in reporting the condition to the surgeon, and this means at night as well as during the day Where no doctor is available, the nurse may have to split the cast throughout its entire length Since the constriction may be caused by tight bandages or padding beneath the cast, these also must be cut



Fig 293 —Correct application of arm sling Note support of wrist The sling ends are crossed on the posterior aspect of the neck and pinned in two places The double pinning helps distribute the weight and there is no pressure from a knot

The skin must be visible from one end to the other The cast, once split and spread, can be taped together temporarily, as it usually does not need to be removed to relieve the symptoms Nurses are warned not to be satisfied with splitting the cast halfway, since this is usually inadequate to release the constriction Unless specifically ordered by the sur

*From *Fractures* By Paul B Magnusson J B Lippincott Co 1949

geon, windows should not be cut in casts The swelling and edema which may occur through the window will only exacerbate the existing trouble

Releasing the constricting cast and bandages may not reduce the symptoms, particularly if they are caused by callus formation which is involving the nerve For this reason, frequent inspection of the digits should follow the spreading of the cast

Occasionally the surgeon will order a small window cut out over the radial artery before the patient is brought back from the plaster room after reduction of such fractures In this manner some check on the circulation in the extremity can be made frequently by the nurse caring for this patient, and it is of great importance that the pulse be carefully taken and recorded at stated intervals, perhaps as often as every fifteen minutes A faint disappearing pulse may indicate pressure on the artery, and should be reported Comparison with the pulse of the unaffected arm will be of assistance in gauging the seriousness of the constriction

Nurses notifying physicians of circulatory impairment should chart the notation and the time at which the physician was called

A word should be said in regard to slings so frequently used after injury to the forearm or wrist If the sling is applied in the common fashion with the long bias edge encircling the wrist and the ends going over alternate shoulders, do not use a knot to fasten the ends at the back of the neck Such a knot places considerable strain on the back of the neck and for relief the patient allows his shoulders to droop forward Small safety pins used to pin the ends distribute the weight of the sling more evenly Some surgeons object to a sling passed around the neck at all, but prefer that it should be passed over the opposite shoulder and under the arm, because if the sling is placed around the neck it is possible for the patient to lower his arm by simply lowering his head A sagging sling, which does not support the wrist and allows the forearm to droop beyond a right angle, is a very sloppy, inefficient piece of apparatus The patient who is wearing a sling to support the arm must be given instructions pertaining to the shoulder joint This joint should be taken through a normal range of motion several times daily to prevent tightness or limitation in shoulder motion

FRACTURES OF THE BONES OF THE LOWER LEG

Nursing Care —Nursing care of a simple fracture of either or both bones of the lower leg, after reduction has been obtained and cast applied, presents no very troublesome features to the nurse If there is considerable swelling, the patient may be admitted to the hospital for a

short period before reduction is attempted Ice bags are frequently used to reduce edema, and it must be remembered that these bags should not be too heavily filled with ice, and care should be taken to eliminate air before the bags are closed The pressure of several very tightly filled ice bags on a swollen and painful ankle has been known to cause great discomfort to the patient, as well as considerable interference with circulation Attention to the underlying skin to eliminate the danger of ice burns is important Ice bags should not be applied without some material between the patient's skin and the rubber even in an emergency Heat is usually substituted for the ice after twenty four to thirty six hours



Fig 294 —X ray views showing internal fixation of fracture of the tibia by insertion of an intramedullary nail (Lottes nail) Fracture of the distal one third of the tibia is frequently complicated by delayed union or nonunion

Walking casts are sometimes applied to patients with simple fractures of the leg in order to allow the patient to continue his normal occupation The manner of applying these casts varies somewhat in different clinics Re enforcements on the sole, either with additional layers of plaster, or with some type of flexible wood, may be used Stirrups or walking irons of metal may be incorporated into the plaster on the

plantar surface of the cast The patient should wear some type of protective sock to keep the cast and foot clean, and a coat or two of shellac when the cast is thoroughly dried is advisable

Complications —Tetanus and gas bacillus infection are two complications of compound fractures with whose symptoms every nurse should be familiar Gas gangrene will first be noted at the site of infection by a local edema, discoloration, and puffiness Increase of the pulse rate is a constant systemic manifestation The complete clinical picture is one of severe localized pain, increase in the size of the limb, rise in



Fig 295 —Long leg walking cast

temperature, continued acceleration of the pulse rate, and a general picture of severe illness The coppery color of the skin, which caused Velpeau to name the disease bronze erysipelas," is a characteristic of a very advanced state Crepitation, which is caused by gas bubbles beneath the skin, is usually present Any of these symptoms after some trauma which has broken the patient s skin is extremely grave and demands immediate surgical attention

General symptoms of tetanus may be absent The earliest symptoms observed may be muscular twitchings and spasms which are tonic in

nature. Frequently there is difficulty in opening the mouth, and this may occur quite early in the course, before any other symptoms have been noted.

Both diseases are caused by anaerobic bacteria, and surgical debridement of the wound is usually done immediately. Where gas bacillus infection is suspected, the wound is opened widely, and all muscle planes in the affected part are exposed. Formerly deep x ray was employed, followed by irrigation through rubber tubes placed so that they came in contact with every section of the muscles involved. Hydrogen peroxide, Dakin's and other antiseptics were used for continuous irrigation. Amputation was frequently required. Antigas gangrene (polyvalent) serum was administered intramuscularly as often as every six to ten hours in doses of 10,000 units. Local use of penicillin and the sulfonamides has largely replaced the x ray treatments and irrigations formerly employed. Serum is still used in large doses, although faith in it as of specific value to treatment is somewhat disputed.

Wounds infected by tetanus are also opened widely, and very large doses of tetanus antitoxin may be given intramuscularly, by vein, or into the spinal canal. In both diseases, supportive treatment is extremely important, and intake is kept up by fluids given parenterally. In tetanus, the convulsive states are managed with sedative drugs, such as Avertin.

PHYSICAL THERAPY IN THE TREATMENT OF FRACTURES

Physical therapy following any type of fracture is recognized to be of great importance regardless of what type of reduction has been used. While nurses will not as a rule be required to carry out these treatments, it is important that they have a good concept of the treatment and its purpose.

The main purposes of physical therapy treatment following fractures are (1) to encourage absorption of traumatic hemorrhage and exudate, (2) to relax muscle spasm and thereby eliminate discomfort and possible deformity, (3) to promote normal circulation in the part and thus to hasten the healing process, and (4) to restore muscle tone and flexibility so that normal functioning is possible.

Heat in some form is almost always part of the treatment. It may be given by means of an electric light bulb suspended in a cradle, by hot packs, by a therapeutic lamp, or by means of a whirlpool bath

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Chapter 37

NURSING CARE OF THE FRACTURE PATIENT—CONTINUED

NURSING CARE OF THE PATIENT WITH FRACTURE OF THE SPINE WITH CORD INJURY

World War II brought about a great change in the attitude of medical people in regard to the treatment of patients with spinal cord injuries Before the war, spinal injuries were often fatal and treatment of patients who did survive was usually limited to the complications and infections which seemed to be inseparable from the condition Very little was done in the matter of total rehabilitation One or two such patients in a community might constitute all that were seen during a single season But during the war, the injury was a fairly common one It became evident early that an intensive reconditioning program would have to be instituted if these unfortunate victims were to be salvaged for anything resembling a useful life The accomplishments which came out of this program have been little short of heroic

This program of physical, social, and vocational rehabilitation was built on the conviction that the task, however difficult, *could be done* From the outset, the attitude of the workers was one of determined hope The pessimism which had always undermined the treatment of this type of patient before was vigorously combated in all phases of the work As General Kirk pointed out early in the war, nothing less than an active, self supporting wheel chair life could be considered for these patients, and walking with the aid of splints and crutches was the goal in all possible cases The time taken to accomplish these things was not to be considered a factor Right at the outset, everyone involved in the process had to be brought to recognize that fact—and this meant the entire medical team, the patient himself, and the family As great a degree of independence as was possible was the aim to be worked for with all patients

Most of the patients with this type of injury whom nurses will care for in civilian hospitals will be boys or young men who have been injured in a swimming mishap, automobile crash, or football accident

It is exceedingly important that nurses recognize the fact that heat has a greater value if administered at low intensity over a long period than when it is given at high intensity for a shorter period of time

When massage is given, it is usually of the light, stroking variety, with slow steady strokes given in the same direction, that is, in the long axis of the muscle and in the direction of venous flow

Muscle stimulation to encourage muscle contraction is usually part of the physical therapy program This may be done through electrical stimulation or through the patient's own voluntary effort (Voluntary effort is usually considered preferable) While this voluntary effort is possible even though the patient is encased in a plaster cast, many orthopedists provide some type of fixation, which, while controlling the fracture site, allows guarded use of contiguous joints Traction, hinged splints, or bivalved casts are particularly useful for this purpose

Active or active assistive exerci es with gentle stretching are frequently prescribed for the patient in traction or splints It is now felt that such treatment may be exceedingly important during the first few weeks following fracture Development of muscle power is recognized to be essential if normal function is to be regained The method of De Lorme, known as the heavy resistance, low repetition method, has worked out well in the hands of experienced physical therapists This method differs from older methods, which concentrated largely on low resistance exercises repeated a great number of times While this method served to develop endurance, it did not always develop muscle power sufficient for the demands of normal function

Some type of apparatus to assist the patient in active exercise of the hip may be attached to the bed This may consist of an overhead frame, skin or ankle traction, and a series of ropes or pulleys which permit the patient to exercise his leg in adduction, abduction, flexion, and extension The patient is taught to do this by himself although supervision of his activities is repeated at frequent intervals

share in this work directly The facilities of the state rehabilitation services should be explored and the patient given the opportunity to learn what this organization can offer him The local or state chapter of the National Society for Crippled Children and Adults may be able to give suggestions The principal of the local high school can often give suggestions as to personnel on the school faculty who would be of assistance in developing skill in certain arts or crafts for which the patient displays interest or ability The teacher of physical education might be willing to assist with a program of physical reconditioning to fit the patient's needs Since community interest in this type of patient is always high, the alert nurse should be able to interest civic groups in aiding her to solve some of the problems in rehabilitation which she is not capable of working out alone

Nursing Problems —A patient with a fractured spine having spinal cord involvement presents what may truly be called a major nursing problem Fractures of the spine may, of course, exist without cord in jury, but these patients do not constitute the great nursing problem that fracture with cord injuries do Attention will therefore be fixed primarily on the more severe type of injury where some degree of cord involvement is present

Injury to the spinal cord is almost invariably accompanied by disturb ances of the bowel and bladder In fractures of the lower dorsal and lumbar vertebrae, these disturbances are especially acute because the spinal segments which control these reflexes are so near the site of injury Cervical and upper thoracic injuries are a more serious immediate threat to life, but if the patient survives, the resulting bladder compli cations may not be so severe

Nurses caring for patients who have a paraplegia from spinal cord injury must constantly consider the following facts (1) Urinary sepsis is the primary cause of death after paraplegia (2) Trophic ulcers and bedsores are the second most common cause of death in the condition Armed with this knowledge, nurses are better able to play an intelligent part in the effort to salvage these patients

Management of the Bladder —Opinions as to the management of the bladder in paraplegia vary somewhat Some physicians feel that every patient with spinal cord injury should be catheterized and an indwelling catheter secured in place at the earliest possible moment It is felt that retention of urine, combined with overdistention, may produce consider able permanent damage to the muscle fibers of the bladder In addition

They have been active and energetic all their lives and the sudden forced helplessness and inactivity may produce profound personality changes Moroseness, depression, sullenness, and unwillingness to co operate in treatment frequently occur Threats of suicide are not un common when the period of recumbency goes on month after month without apparent progress It takes considerable emotional maturity to understand such attitudes and yet to maintain an unwavering deter mination to guide the patient toward more constructive thinking, so that he is willing to do his utmost toward attaining independence Probably the most important single feature in preventing despair and depression is early mobilization The fact that he is not to be confined to bed and complete helplessness for a prolonged period will aid the patient immeasurably by giving him something to live for, and it will also play a most important part in preventing loss of muscle tone, stiff joints, and contractures such as occur in the plantar fascia, causing pes cavus, or in the gastrocnemius and tendon of Achilles, causing drop foot

Nurses in small hospitals and small communities will feel particularly helpless in attempting to plan a program of activities to fit the para plegic patient's need Nevertheless there are often resources within the community which can be called upon for assistance if the nurse recog nizes their existence and their potentialities And it is particularly im portant that this assistance be solicited at the earliest possible period after danger to life is past A long period of idleness in which the pa tient becomes more and more pessimistic about his lot is often the fore runner to severe personality changes which could be prevented by a program of therapy instituted at the earliest possible moment

But where is the nurse to obtain help in planning such a program if there is no physical or occupational therapist or physical education consultant on her agency or hospital staff?

The physician is, of course, the chief adviser in all such matters and should direct the patient s activities in the projected recovery program, but he cannot be expected to work out the details of such a program, nor to be on hand to direct every feature of it He will expect the nurse to explore community resources and to make sensible use of them under his direction

All nurses should know the location of their State Services for Crip pled Children in order to call upon them for assistance when the need arises The orthopedic nursing consultant employed on these services will be able to give valuable suggestions as to how to obtain assistance in planning such a program In some instances she may be able to

ration of materials, hands, and area before implementation The patient's liquid intake should be high—at least 2,500 c c and preferably nearer 5,000 c c daily And last but not least, the patient's position should be changed at frequent intervals to eliminate stasis of the urinary tract which might contribute toward the formation of renal stones

Gastrointestinal Complications —The patient with compression fracture of the spine may frequently have a troublesome stasis of the gastro intestinal tract The abdomen may be ballooned to drum like tenseness by distention of the bowel and respiratory embarrassment may be present because of the crowding of the chest Turpentine stupes or hot foments to the abdomen for relief of distention are sometimes ordered The danger of too excessive heat must be borne in mind, for if the patient has sensory loss, he will not complain that the packs are too hot, and blistering of the skin may follow Rectal tubes may sometimes afford considerable relief Enemas must be given with extreme care because the intestine of the paraplegic patient distends very easily if too much liquid is given or if it is given too fast It is always wise to measure the amount of fluid given by enema and to record the amount of fluid which the patient expels All patients with spinal cord injury must be watched constantly for fecal impaction

Prevention of Bedsores and Trophic Ulcers —The problem of bed sores in the paraplegic patient is without doubt the most serious consideration from the nursing standpoint Pressure areas develop with a speed which will seem unbelievable to nurses who have not worked with such patients before Some physicians prefer that patients with spinal cord injuries be placed on air or water mattresses immediately so that the pressure of the bed will not be concentrated on certain vulnerable parts of the body, such as the sacrum or the heels * However, there is no general agreement on this subject, for other physicians are strongly opposed to this type of mattress The use of rubber rings and doughnuts is considered unwise because window edema so often develops from their use Window edema will, of course, cut off circulation to the threatened part and thereby add to the damage

Frequent changes of position are imperative Orders will often be written to turn the patient as frequently as every one to two hours, day and night Even if this is done, intelligent understanding of the dangers of side lying and prone lying is necessary, for congested areas often develop on dependent parts and bony prominences even though the

*Pascal s Law Fluid transmits pressure equally in all directions

residual urine adds to the danger of urinary tract infection Nurses will recognize that it is of the utmost importance to use the most careful aseptic technique in catheterization procedures Even the compelling necessity for haste and the conviction that the patient will not survive are no *reasons for using careless methods in catheterizing a patient after* cord injury

Other physicians object to urethral catheterization for these patients They feel that the problem of retention is not as urgent as was formerly thought They believe that overflow incontinence will cause no permanent ill effects and point out that the catheter has long been considered the "grand executioner" for patients with paraplegia They have observed that the bladder goes through three periods following cord injury (1) complete retention of urine, (2) retention with overflow, and (3) periodic reflex (automatic) voiding When this sequence is not complete, these physicians tend to prefer suprapubic aspiration or cystotomy rather than urethral catheterization

The establishment of the automatic bladder is frequently part of the management of patients recovering from spinal cord injury When it seems evident that voluntary control of the bladder is not going to be attained, manual expression of urine is attempted At stated intervals, pressure is exerted upon the abdominal wall over the bladder, and this pressure is continued until the bladder contracts by reflex action powerful enough to cause the sphincter to relax and the bladder to empty itself This is done at intervals of from four to six hours It has been found that less pressure is necessary after the bladder becomes used to this system, and the patient may carry out the manual pressure by himself

In the army it was customary to do cystotomies on all paraplegic patients within five days after the injury A suprapubic catheter was placed in the bladder Tidal drainage may be instituted Tidal drainage resembles the natural physiological functioning of the bladder It consists in filling the bladder with liquid at a rate of from 40 to 60 drops a minute It is so arranged as to provide gravity and siphonage, with automatic emptying of the bladder every two or three hours It has not, however, been found wholly effective in the case of the paraplegic with complete cord transection

As has been stated, the problem of bladder management is always a major one in this condition Nurses should be most careful to do everything in their power to eliminate chances of infection by careful prepa

the cells is so smooth that it is barely perceptible to the hand It produces a massaging effect to the cutaneous tissues and provides for a continuous change of pressure points With improved circulation to the skin and the changing pressure points, the danger of decubiti is somewhat lessened This pad not only facilitates the care of the patient in the hospital but is something that the family can use in the home to help prevent pressure areas

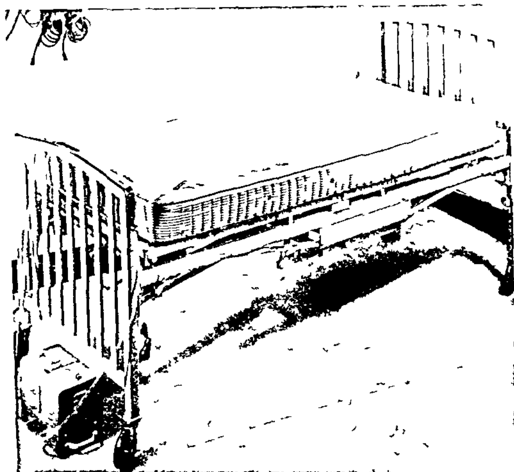


Fig 296 —Alternating Pressure Point Pad The pad is placed on top of the regular mattress A Pliofilm apron which is attached to the head end of the pad tucks beneath the mattress and maintains the pad in position (Courtesy Grant Messenger and Associates Cleveland Ohio)

Nursing Care of the Patient on a Foster Bed—During the past decade, many patients whose care has necessitated the use of a frame have been placed on a Foster or Stryker frame This apparatus is similar to the Bradford frame, except that both the anterior and posterior frames have been fitted on a standard which has a pivoting device

patient lies on these areas only for an hour The ingenuity of the nurse will be taxed to the utmost to find positions which will not cause undue pressure to fall on any body area for too long a period

Pads of thick porous sponge rubber may be placed under the sacrum and heels when the patient lies on his back, or under the ilium, tro chanter, and malleolus when he lies on his side These pads should be large enough to extend under a wide area Large squares of unclipped sheepskin will also be found helpful This material can be washed daily in warm water with a mild soap It should be rinsed thoroughly and dried if possible in the sun

The linen used on the paraplegic patient should be carefully inspected, no new or stiff harsh sheets should be used Drawsheets should be placed on the bed to facilitate changing of linen, for a wet bed is a great menace to the paraplegic patient's skin He should never be allowed to lie in a wet bed for even a short period Wrinkles in bed linen will also contribute toward the development of pressure sores

Nurses must remember that patients with paraplegia are unable to feel cold in the paralyzed extremities, and that circulation in these parts may be very poor Hot water bottles, even of fairly mild tem peratures may produce blisters that are almost impossible to heal Death from infected bedsores can come about in a very few days They are not merely a troublesome complication in paraplegia, they may very easily be a fatal one It is best to depend on sufficient wool covering for warmth, rather than to risk using external heating equipment on such patients

In recent years many paraplegic patients have been cared for on special types of apparatus such as the Foster bed the Stryker frame or the Alternating Pressure Point Pad This new apparatus has been designed primarily to prevent pressure areas and to facilitate nursing care

Alternating Pressure Point Pad or Pneumatic Mattress—This pad is made of air cells one and one fourth inches in diameter, running trans versely or longitudinally of the bed Every other cell is connected to an air tube which comprises the edge of the mattress This arrangement provides for two systems of air cells These air cells are alter nately inflated and deflated by an electrically driven air pump The air is shifted first into one system and then into the other This means that the patient's body is alternately resting on the odd numbered cells and then on the even numbered cells The cells are inflated and de flated at intervals of two to three minutes This interchange of air in

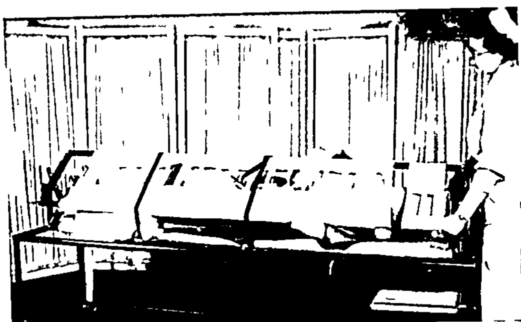


Fig 299—The screw lock has been loosened and the turning process started Note ties of muslin sheet covering the canvas frame cover Also note the narrow strip of canvas used to support the patient's forehead when in the prone position

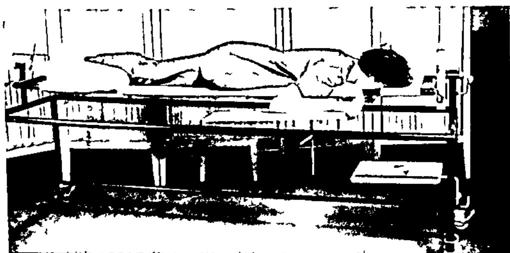


Fig 300—Prone position on the Foster bed The posterior frame has been removed and will have needed linen changes while the patient is on the anterior frame In this position the patient can use the lower shelf for holding reading material or his diet tray may be placed here

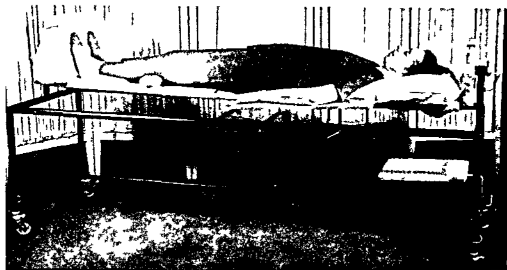


Fig 297 —Supine position on the Foster bed Note footboard maintaining neutral position of the feet small pad to prevent pressure on the heel and the roll placed beneath head of the tibia to prevent hyperextension of the knee joint The rack to hold the bedpan is hooked over the frame edges beneath the divided frame cover

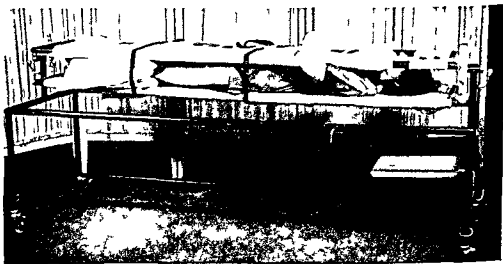


Fig 298 —The anterior frame has been fastened so that the patient is held snugly between the two frames Turning straps have been applied to give added security The adjustable arm boards have been removed in readiness for turning Note the pulley at each end of the frame These may be used in the application of cervical or leg traction Also note pegs in legs which permit elevation of either end of the bed

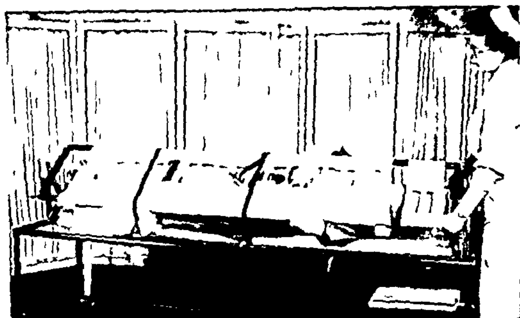


Fig 299.—The screw lock has been loosened and the turning process started Note ties of muslin sheet covering the canvas frame cover Also note the narrow strip of canvas used to support the patient's forehead when in the prone position

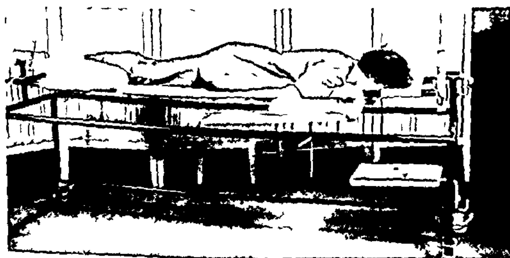


Fig 300.—Prone position on the Foster bed The posterior frame has been removed and will have needed linen changes while the patient is on the anterior frame In this position, the patient can use the lower shelf for holding reading material or his diet tray may be placed here

This pivoting device makes it possible, in many instances, for one nurse to turn an adult patient Not only is it easier to turn the patient, but better immobilization is secured and consequently the patient experiences less pain in turning These frames are used primarily in the treatment and nursing care of patients with various back conditions The patient with spinal cord damage may be placed on this type of bed Good position can be maintained and it is possible to turn the patient frequently, thus changing the pressure points

Canvas covers are used with these frames the same as with the Bradford frame They may be fastened with buckles or with lacings but must be firm and taut continuously Divided covers are frequently used However this can vary, depending on the diagnosis of the patient and the purpose for which the frame is being used The divided cover for the upper half of the posterior frame should extend from the top of the frame to the level of the patient s buttocks (gluteal cleft) A space of approximately four inches is left for the perineal opening The lower half of the posterior cover extends to the end of the frame The upper portion of the divided cover for the anterior frame will extend from the patient's shoulders to the symphysis pubis Again a space of four inches is maintained for the perineal opening, and the lower portion of the anterior cover extends to the level of the patient s malleolus This arrangement permits the patient s feet when lying in the prone position to extend over the frame cover Some type of support must be arranged for the patient s forehead or face This usually consists of a narrow canvas strip buckled at the top of the anterior frame When caring for an incontinent patient on the frame, it will be necessary to protect the canvas covering around the perineal opening with a waterproof material, such as Pliofilm A narrow canvas strip is buckled across the perineal opening when the bedpan is not in place This prevents the patient's buttocks from sagging and helps to maintain a good back lying position

The frame may be padded with cotton blankets folded to fit the frame, or strips of sponge rubber cut in the desired size can be used The outer linen covering is made to fit the frame and is held in place by tying on the underneath side When turning the patient from the supine to the prone position, place a pillow crosswise above the dorsum of the feet The top frame is fastened in place so that the patient is held snugly between the two frames Two or three canvas turning straps are buckled around both frames and the patient This gives the patient

added security and will prevent the limbs from slipping during the turning process The arm boards are removed, and the screw or spring lock which keeps the frame from turning is released The patient is instructed as to which way he will be turned If he is being turned by one nurse, it is best that she move to the side of the frame The turning should be done quickly and smoothly After turning the patient, the screw or spring lock must be in place, before the nurse's grasp of the frame is released This screw or lock holds the frame firmly and prevents turning The straps and upper frame are removed, and back care can be given The covers and linen are changed when that half of the bed is not in use

These frames may be used even when it is necessary for the patient to have traction applied The frames are constructed so that traction can be applied to the patient's lower extremities or to the cervical region

The general nursing care of the patient is the same as for other bed patients Skin care, change of position, prevention of deformity, and maintenance of normal joint motion are essential for his rehabilitation

Treatment of Bedsores and Trophic Ulcers —Treatment of pressure sores and ulcers in the paraplegic should be directed by the physician, for the problem is too serious to be left entirely to the nurse's judgment Pressure sores in other conditions may safely be considered more or less of a nursing problem, but in paraplegia the patient s life may depend upon the kind of treatment he receives for this condition

Except for the universal acknowledgment of the need for frequent turning of the patient, there is no unanimity of opinion regarding the treatment of established pressure sores There are numerous types of ointments, pastes, and lacquer which may be used Irrigation with antiseptic solutions is frequently ordered for the deep decubitus Bactericidal lamps and sunlight have sometimes brought about surprising improvement Sulfonamides and penicillin, either in ointment or solution, may be helpful in combating infection The old tried and true method of cleaning the wound with green soap, followed by alcohol, and a thin layer of boric acid ointment is still used in many places Immersion of the patient in a Hubbard tank or salt pool is recommended by some workers Following this treatment, the involved area is dried with a hair drier and local ultraviolet irradiation is given

Large bedsores which heal slowly are sometimes treated by surgical closure To insure the success of this treatment, the patient should be

built up with a high protein, high vitamin, high caloric diet before surgery is undertaken Amino acid intravenous therapy is also sometimes used to prepare the patient for skin grafting Following surgery, the patient may be placed on a Stryker frame for easier handling

It has been found that fully developed, deep decubiti are the source of great loss of body protein It is therefore important that any patient who is receiving treatment for bedsores and trophic ulcers should have a diet high in protein A diet containing 150 to 200 mg of protein daily is considered essential The salt intake should be increased in the diet, and large amounts of all vitamins, with particular attention to vitamin C, are usually considered important

Prevention of Deformities and Joint Contractures—When caring for the paraplegic patient, it is imperative that the nurse understand and apply the principles of good body alignment Second she must have an understanding of normal joint motion These patients will need to have the joints of the affected extremities taken through a range of motion daily This activity is usually ordered and supervised by the attending physician In some of the larger hospitals, we find the physical therapist assigned this responsibility, but, in smaller hospitals, the nurse is the person who must assume the task of preventing joint contractures *Fibrosis of ligaments and ankylosis of joints will occur* within a short time, if joints are not moved Good body alignment and normal joint motion have been described in an earlier chapter

Bed Positions in Fractured Spine—In fracture of the spine which is not accompanied by permanent cord injury or spinal fluid block, the patient is sometimes placed on a sponge rubber mattress which is superimposed on an ordinary firm felt mattress, and bed boards The feet are kept in the normal physiological position, the knees relaxed with a knee roll, and the limbs cradled so that the weight of the bedclothes is eliminated Sometimes spinal hyperextension is ordered This may be obtained by placing a blanket roll beneath the felt mattress at the desired position, or the patient may be placed in a Gatch bed with his head at the foot of the bed and the knee rest elevated This will provide hyperextension of the spine and has the advantage of being easily alterable The elevation of the knee rest is usually around three inches at the beginning of the treatment It may be increased two inches daily until a maximum elevation of around ten inches has been reached Occasionally, reverse peristaltic action, accompanied by vomiting, may occur during this process *If this happens, further elevation of the Gatch should not be attempted*

The patient may be kept in hyperextension for around two months, and if the x ray is then satisfactory, he may be out of bed in some type of back brace prescribed by the physician The Taylor back brace is frequently used *If bowel and bladder disturbances were present at the outset*, the patient will usually have regained control by this time



Fig 301 —Maintaining a hyperextended position of the spine by use of the three-crank Deckert bed The amount of hyperextension can be increased or *decreased according to need The same position can be secured with the ordi* nary Gatch bed by placing the patient s head at the foot and then elevating the knee rest

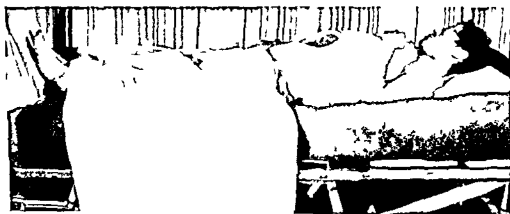


Fig 302 —Illustrating a body cast which has been applied to maintain the spine *in a hyperextended position*

Patients in hyperextension casts may be given a regime of exercises designed to strengthen the body musculature, particularly the back ex tensors, which will be of great importance when the cast is finally removed

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Although such emergencies are not common, it has sometimes happened that skeletal traction in the skull becomes loose and actual slipping out of the tongs may result. For this reason a set of alternate equipment should be kept on hand which the nurse may apply until she can reach the physician. A chin halter, a spreader, some rope, and a few sandbags will suffice to maintain hyperextension until the tongs can be replaced in the skull.

The patient with cord transection presents a more difficult problem. Traction, frames, splinting, and even positioning in bed are of doubtful value, for they seem only to stimulate the mass reflex which brings about contractions of muscles around joints. Furthermore, apparatus applied forcibly to maintain a desired position almost always causes pressure sores to develop. But, as the patient improves generally, the tendency to flexion and adduction deformities becomes a most perplexing problem. Even turning the patient in bed may set up abnormal motor impulses that are almost impossible to control.

Because this mass reflex is so difficult to combat and is so distressing to the patient, surgery is sometimes done to eliminate it. Surgery may consist in cutting of the anterior spinal roots from the twelfth dorsal to the first sacral segment intraspinally on both sides. This produces a flaccid paralysis which eliminates the constant tendency to flexion and adduction which the mass reflex brings about. And, since the bladder is no longer constantly stimulated by contraction of the abdominal muscles, tidal drainage may be instituted. It is then possible to care for pressure sores more adequately because the bed can be kept dry and the patient turned frequently. Physiologic bed positions are also possible and the patient can be made comfortable and deformity prevented with the usual supports for feet, knees, and back.

CERVICAL CORD INJURIES WITH QUADRIPLEGIA

A patient with a cervical fracture with some cord injury will have a quadriplegia of varying degrees of severity. Frequently these individuals who survive present a picture of spastic rather than flaccid paralysis with involvement of all four extremities. They are of course entirely dependent upon others for assistance during the early stages of their illness, and the outlook may seem particularly black and hopeless to both nurse and patient. Nevertheless, many of these patients regain partial independence and have been able to live a fairly normal life

Skeletal traction, applied by tongs inserted in the parietal eminences of the skull, is frequently used for reduction of fractures and dislocations of the cervical vertebrae In some instances it may be necessary to use rather large amounts of weight in order to reduce the fracture Progress of reduction is checked by x ray examination, and, when complete reduction has been obtained, the amount of weight is usually decreased

The nursing care of the patient with traction in the skull is not as difficult as it is when some type of chin or occipital halter is used When the latter is used, the skin tends to break down easily because of the large amount of weight which must be used to obtain reduction of the fracture Furthermore, turning the patient is not permissible since traction efficiency must be sacrificed during the process With the Crutchfield type of skull traction, however, careful turning of the patient for back care is permitted The patient must be watched for signs of cyanosis during the process, or for dyspnea which might indicate further damage to the cord

Body alignment should be carefully maintained during the turning process, and the patient should be turned as though he were a log and would not bend A pillow should be placed in front of his chest to support the shoulder and arm and another should be placed between thighs and legs to prevent sagging of the hip Either of these conditions—sagging of the hip or shoulder in side lying—will inevitably alter the position of the spine and should be avoided

It is sometimes necessary to provide spinal hyperextension in conjunction with the skeletal tongs For this, two mattresses may be placed on the bed, one of which is in the usual position, while the upper one (which may be a rubber or air mattress) reaches only to the patient s shoulders Hyperextension of the cervical spine is obtained by allowing the head to fall back over the upper mattress and rest on the lower one The same effect can be obtained by placing a firm pillow under the patient s back from the sacrum to the shoulders A thin pillow or pad may be used for comfort under the head

The stab wounds through which the tongs are introduced into the skull are usually dressed with small circular sponges, saturated with collodion to make a waterproof dressing Very little danger of infection exists, although occasionally this does occur Inspection of the wound dressings should be made each day but the dressings are not disturbed without order of the surgeon Tightening of the tongs is usually done by the surgeon or his assistants

Although such emergencies are not common, it has sometimes happened that skeletal traction in the skull becomes loose and actual slipping out of the tongs may result For this reason a set of alternate equipment should be kept on hand which the nurse may apply until she can reach the physician A chin halter, a spreader, some rope, and a few sandbags will suffice to maintain hyperextension until the tongs can be replaced in the skull

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Quadriplegic patients will not be able to perform the sitting up, pushing up, or rolling exercises as efficiently or as quickly as the paraplegic whose arms are not involved. The whole program of reconditioning must be built on the patient's potential ability and modified from day to day to meet his needs. Unless the condition is complicated by debilitating diseases, such as hypostatic pneumonia to which these patients are particularly vulnerable, attempts should be made to get the patient on his feet as soon as possible. Frequently it is necessary to strap the crutches to the patient's arms to enable him to begin weight bearing. Where involvement is not too severe, he may learn to master the four-point gait.

QUESTIONS FOR STUDY—UNIT XII

1 Discuss some of the home hazards which may lead to fractures

2 List two common complications which follow fracture of the femur in the aged What can good nursing care do to eliminate these?

3 Discuss prevention of pressure areas in the aged who are confined to bed with fractured limbs

4 How would you prepare an elderly patient, recently removed from a hip spica cast to begin functional activities such as getting up in a chair and using crutches?

5 What is the aim of all treatment for the paraplegic patient?

6 What are the two most common causes of death in the patient with paraplegia? What can good nursing care do to eliminate these?

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Unit XIII
BONE TUMORS

Chapter 38
BONE TUMORS

Any localized abnormal enlargement in the bone or surrounding the bone is called a tumor, but it is generally considered that the element of new growth, whether slow or rapid, is essential to classifying the enlargement as a tumor

There are, in general, two types of tumors, malignant and nonmalignant The nonmalignant type grows slowly and does not tend to destroy either bone or the surrounding tissue, nor does it tend to spread through the blood stream or lymphatic system to other parts of the body There are fibroma, lipoma cysts, warts, and exostoses

The malignant tumor is usually rapid in growth and may spread to other parts of the body before it is actually recognized by the patient and before it is brought to the attention of the surgeon

CAUSE

The cause of some of the benign, or nonmalignant, tumors, such as overgrowths of bone and cartilage in the region of the joints, is known to be due to misplacement of growing cells during embryonic development As bone growth takes place, these misplaced cells also grow and may cause enlargements about the joints which may interfere with joint function and which may be susceptible to constant irritation by virtue of their prominence Occasionally, malignant change may take place as a result of such irritation

The cause of malignant tumors is not known Heredity seems to play some part They consist in rapid and uncontrollable growth of cells which may spread through the blood stream and continue their growth in the lungs, and in other bones and in the glands Death may follow within a few months

Cancer of the breast, uterus, prostate, or intestinal organs may pass through the lymphatic drainage system and deposit growing cells in the bones of the spine, ribs, arms, legs, or elsewhere As a rule, this is the cause of pain, but occasionally the first indication of bone involvement comes when a fracture occurs as the result of some trivial accident Compression fractures of the spine are very common when cancer cells have weakened the structure of the bones of the vertebrae, or there may be pathological fractures of the hip, shoulder, or pelvis

TREATMENT

The treatment of bone tumors must be discussed from several standpoints In the first place a surgical biopsy is the surest way to establish an accurate diagnosis In the case of benign tumors the treatment will be guided by the symptoms produced Surgical removal is indicated if the tumor interferes with tendon, muscle, or joint function Occasionally one is removed for cosmetic reasons

In the case of malignant bone tumors surgical removal is the treatment of choice whenever it is technically feasible Removal often means amputation or disarticulation if the tumor involves the bones of an extremity Where metastasis can be demonstrated, as in the chest, the surgical removal of the original tumor will obviously not cure the patient, yet will be done to control pain and to prevent the local tumor from becoming an ulcerated, fungating foul smelling mass

X ray irradiation, or radioactive cobalt (bomb) radiation will be used in cases where the tumor is radio sensitive Some tumors such as Ewing s can be controlled for many months by this treatment Radiation is often times helpful to relieve pain in tumors even though it may not be curative

In the far advanced stages of malignant bone disease and in tumors from other parts of the body that have metastasized to bone, drugs have been and are being tried in an effort to find one that might control the growth of the tumor cells Needless to say, the control and cure of cancer generally is not known but many drugs, especially in the field of steroids (hormones), have been found useful

NURSING CARE OF PATIENTS WITH MALIGNANT TUMORS OF BONE

Nursing care of patients with malignant bone tumors does not differ greatly from the care given to a patient with malignancy of any part of



A



B

Fig 303 *A* and *B*—Osteogenic sarcoma of humerus

the body Very few of the features of it will be unfamiliar to the orthopedic nurse experienced in the care of bone infections The early symptoms of this condition, however, may be of interest to the student who sees these patients only at a time when the process is fairly well advanced The two most common types of malignant tumors affecting bones (osteogenic sarcoma and Ewing's tumor) occur most frequently in young people under twenty The early symptoms are intermittent pain, which is particularly troublesome at night, tiredness, and a slight limp Such a combination of symptoms requires immediate medical attention Sometimes the parent will belittle the symptoms as being the result of some recent fall or trauma Needless to say, the nurse "suspectician" who advises the patient to seek medical attention does not voice the nature of her suspicion

The patient frequently looks deceptively well when admitted to the hospital for the first time The night pain, however, tends to increase in severity The patient's morale suffers considerably because of it Anemia develops rapidly, and the patient begins to look fragile and pale Temperature may show some elevation

The prognosis for these patients is bad One watches week by week the local and general progress of malignant disease Their own outlook at first is hopeful Whether or not amputation takes place, they usually display early desire and determination to get well Since they presumably know nothing of the moribund nature of their disease, one wonders sometimes at the gradual change that comes about in the morale of these patients Consciously or unconsciously they seem to know the outcome. It has been said that the attitude of parents, visiting friends, and even nurses toward the patient tells him the whole story quite clearly This is probably not entirely true But there is enough truth in it that the nurse needs to help the relatives understand the necessity for self control in the presence of these patients This is a stern lesson, but an important one, and it is just as important for the nurse to learn it as for the parent

Splinting of the extremity is done to prevent pain or injury to the involved part The chance of pathological fracture occurring at or near the site of the tumor is to be kept in mind, for very little trauma or manipulation is necessary to bring about such fractures This should be remembered during the bed making process, or when the patient is turned, and especially if he is allowed out of bed In the latter case he should be carefully protected against bumps or falls

Where x ray treatment is prescribed, instructions should be sought from the surgeon regarding the patient's routine treatment It is usually considered unwise to continue heliotherapy while the patient is receiving a course of x ray treatments, since the patient's skin at this time is particularly sensitive to light The diet is usually fortified by additional vitamins and protein and by blood building foods to counteract the advancing anemia

Symptoms which the nurse should recognize as indicative of progress of the disease process are particularly signs of chest involvement, the most common site of metastasis Coughing, pain in the chest, and expectoration of blood are serious and should be reported immediately Fracture may occur from relatively trivial mishaps and, since the fracture is almost painless, may go unnoticed unless the nurse is vigilant in observation

QUESTIONS FOR STUDY—UNIT XIII

1 Give the main points of difference between a malignant and a benign tumor

2 What are two complications an observant nurse might recognize in bed care of the patient with a malignant bone tumor?

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Unit XIV
NEUROMUSCULAR AFFECTIONS

Chapter 39
PROGRESSIVE MUSCULAR DYSTROPHY

CAUSE

The cause of pseudohypertrophic progressive muscular dystrophy is unknown There is a definite hereditary factor and it is transmitted frequently in the same manner as hemophilia, through the unaffected mother to the male children Occasionally, however, it occurs in females, where the disease is usually not so severe and tends to disappear with the beginning of menstruation The disease is thought to be due to some disturbance in the nervous mechanism, possibly the end plates, which cause the immediate "fuse action" effect of power development in the individual muscle fiber This mechanism has been investigated by Dr Eben Cary of Marquette University

TYPES

There are two main types, the infantile and the juvenile The infantile starts between two and four years of age, tends to develop rapidly and death frequently occurs at eight or twelve years from weakness and concurrent diseases The juvenile type usually starts between the tenth and fourteenth year, is slow in development, and the individuals may go through a relatively normal life, reaching even ages of seventy or eighty

SYMPTOMS AND SIGNS

The first symptoms usually consist in the tendency to walk on the toes with a slightly waddling gait and an enlargement of the calf muscles As the disease advances, intermittently, the waddling gait increases and an exaggerated hollow back develops The muscles about the thighs,

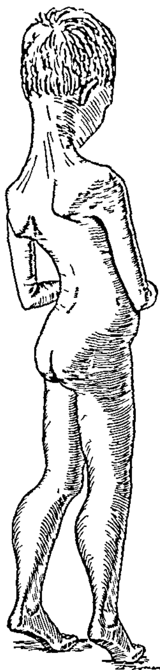


Fig 304 —Moderately advanced case of infantile pseudohypertrophic progressive muscular dystrophy Note enlarged calves contracted heel cords, sway back, and winged shoulders

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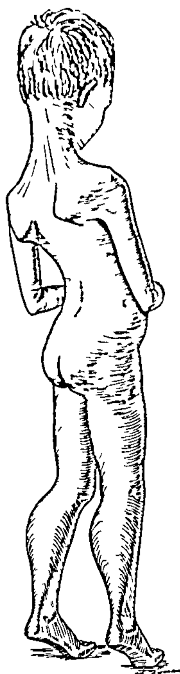


Fig 304—Moderately advanced case of infantile pseudohypertrophic progressive muscular dystrophy Note enlarged calves contracted heel cords, sway back, and winged shoulders

hips, and shoulders atrophy The fibers of the enlarged calf muscles become displaced by fat and fibrous tissue It is characteristic that these children when placed in a sitting position on the floor first arise to their knees and hands, awkwardly bring each leg up separately to a flexed weight bearing position, and then with their hands against the knees and thighs they gradually force themselves up into an erect position Even then, they have great instability and a small blow against their knees or other parts of their bodies may throw them off balance and cause them to collapse to the floor

In later stages, extensive wasting of the muscles occurs and the limbs and spine may assume grotesque deformities

TREATMENT

Glandular treatment and many combinations of it have been tried in vain The use of glycine, pilocarpine, and other stimulative drugs has not proved effective in many cases During the development of the disease braces may be used for support of weakened areas

Chapter 40

BIRTH PALSY (ERB'S PARALYSIS)

CAUSE

Birth palsy consists in a paralysis of the arm caused by damage to the brachial plexus during the process of birth It may occur spontaneously during a relatively difficult labor or may result from the use of instruments or from traction on the arm in abnormal labor

TYPES

There are two common types (both are becoming less frequent with improved obstetrical methods) the milder type in which only the muscles about the shoulder are paralyzed (Erb's paralysis) and the severe type in which the whole arm is paralyzed (Aaron Duchenne type) In both types the arm is rotated inward by the unparalyzed pectoral and scapularis muscles These become contracted if the condition remains untreated for any great length of time and the deformity becomes fixed

The prognosis in the Erb's type of paralysis is good it is poor in the *whole arm* type or the lower arm type (Klumpke)

TREATMENT

In the milder type, the nerves are injured and the paralysis is usually due to the pressure of hemorrhage on the brachial nerve trunks Recovery usually takes place but the arm must be maintained in a position of abduction and external rotation to release the paralyzed muscles and to prevent contracture of the unparalyzed internal rotators and adductors The treatment should be started *very soon after birth* and immobilization may be done either by means of an abduction splint, which extends from the pelvis to the tip of the fingers, or by means of a plaster of Paris cast If the splint is used, daily applications of heat and massage and the use of active and passive exercises speed up recovery

When the cast is used, the upper portion over the arm should be removed at the end of two or three weeks so that treatments can be carried out Recovery usually takes place in from six to ten weeks

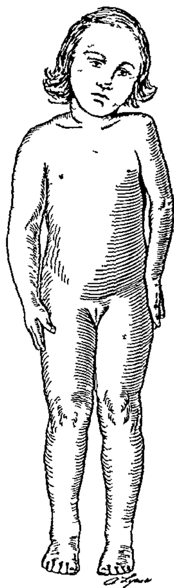


Fig 305 —Birth (Erb s) palsy of left arm in child of six years There is inward rotation adduction and atrophy

In the severe, whole arm type there is usually formidable damage or complete severance of some of the roots of the brachial plexus Inspection by operation and suture of these nerve roots will sometimes lead to partial recovery The arm should be splinted in this type also, but recovery, if it occurs, is at a very slow rate

NURSING CARE

Early recognition of birth paralysis is not difficult It is frequently suspected by the obstetrician as he delivers the child The causative factor being a forcible separation of head and shoulder" during delivery This produces a tearing injury of the nerves of the brachial plexus The nurse giving the initial bath will note the characteristic position of the arm, which hangs flaccidly with the elbow in extension, the shoulder adducted and rotated inwardly—often accompanied by a cupping appearance of the shoulder—the hand pronated, palm facing the back The infant does not use the arm and will object to its being moved for him during the first days of life This gradually subsides, and the arm can be moved without pain to the child

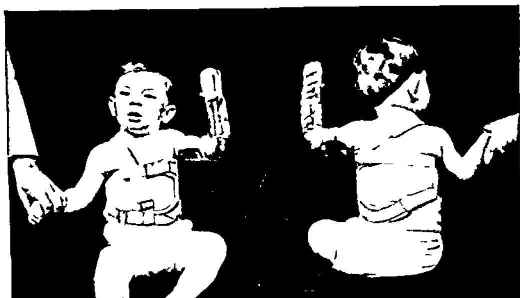


Fig 306 —Abduction arm brace The arm is maintained in abduction and external rotation The thoracic and iliac portions ensure stability of the brace and a part of the weight of the apparatus is distributed to the well shoulder (Courtesy Arthur Steindler)

Difficult, prolonged labor seems to play a definite part in the etiology of this condition, since anesthesia is employed in these cases, and considerable muscular relaxation is present during birth In cases with extreme tearing, Sever says unequal pupils (Horner s signs) can frequently be observed

Treatment is ordered immediately, though it may be only a tying of the child's wrist to the crib head The purpose of treatment is to prevent stretching of the paralyzed muscle and contracture of the unaffected groups The arm is therefore secured in a position where strong

muscles cannot become shortened and contracted This is done by casts or splints, and the position is the so called "Statue of Liberty attitude in which the arm is abducted, elevated, the shoulder rotated externally, and the hand in a position of supination

Physicians' orders as to care and handling of these patients may vary in some degree Constant protection of the affected muscles to prevent them from being stretched by the opposing group is the usual order The nurse must be able therefore to improvise methods of support for the arm when the brace or splints are removed during the bath and exercise In an infant or young child this is not a very easy assignment The nurse should not remove the brace until she has everything in readiness to bathe the part Securing the wrist to the head of the crib with a clove hitch of muslin bandage is frequently done A linen splint, devised originally at Michael Reese Hospital for protection of the deltoid in infantile paralysis, would provide an excellent means of maintaining good position at such times as the brace must remain off for periods of hours—for repair, cleaning, or the like

Other surgeons will alternate protection with periods of supervised activity or manipulation during which the joints of the upper extremity are passively put through their full range of motion

The type of physical therapy is ordered by the surgeon and is carried out by a physical therapy technician if one is available If it is necessary for the nurse to perform this function, she should ask the doctor to demonstrate the treatment to her before she assumes the responsibility It will usually consist of light massage and manipulation of the affected extremity

Chapter 41

CHARCOT JOINTS AND OTHER NEUROMUSCULAR AFFECTIONS (NEUROPATHIES)

These are not truly neuromuscular affections but are enough allied to be included in this chapter.

It is well known clinically and by x ray that the bone, cartilage, and ligaments can at times literally melt away, leaving a very misshapen, unstable, unserviceable, and yet quite painless joint. This is known as a neuropathy and occurs particularly in association with certain nervous tissue disorders such as neurosyphilis, diabetic neuritis, syringomyelia, and occasionally paraplegia. The name Charcot has been applied to these joints.



Fig 307.—Charcot joints. The x ray illustrates extensive destruction of bone. The patient experiences little or no pain but such joints are quite unstable and weight bearing is difficult.

There is no specific treatment except to treat the underlying cause: penicillin for neurosyphilis, diet and insulin to control the diabetes, and x ray therapy for syringomyelia. The unstable joint does not heal, but occasionally the progression of the process can be checked. Attempts at fusion or application of braces will benefit the involved joints.

QUESTIONS FOR STUDY—UNIT XIV

1 Be prepared to discuss the three types of brachial palsy as to nerve roots and muscles involved and as to loss of motion Describe typical position of the arm

2 What is the treatment and what are the nursing responsibilities as related to early diagnosis, to nursing care to provision for adequate follow up care

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GLOSSARY

Achondroplasia A form of dwarfism in which the trunk and head are of almost normal size but in which the limbs are short and sometimes distorted It is due to a disturbance in epiphyseal growth which originates in intrauterine life It is definitely congenital and frequently inherited

Acromegaly (Gigantism) With overgrowth of stature there is enlargement of the jaw, shoulder girdle, pelvis hands and feet It usually develops (1) during periods of rapid growth in adolescents but may occur (2) in adult life

Actinomycosis (Blastomycosis Lumpy Jaw) Infection is usually first manifested in the bones of the jaw In a small proportion of cases the spine is involved Destructive areas of interest to orthopedists are found in the spine and there is usually some abscess formation The diagnosis is made by the ray fungus obtained by aspiration of the abscess Treatment may consist in drainage evacuation of the abscessed area or x ray therapy which usually leads within six months or a year to cure

Adactylism Absence of the fingers or the toes

Amputation Neuroma An enlargement at the end of a cut nerve usually composed of jumbled scar and regenerating nerve tissue and often painful

Amyotonia Congenita Inherited weakness of the muscles It may persist through adult life or may respond to antirachitic therapy in earlier life

Ankylosis Stiffening of a joint This is caused by scar tissue or bone growth between the two surfaces of a joint It occurs as a result of infection or irritation

Arthrodesis Surgical fusion of a joint

Arthrogryposis Flexion contractures of the limbs (congenital)

Arthroplasty The operative creation of a new joint to replace a stiff or ankylosed joint

Arthrotomy Operative exploration of a joint

Brachydactylism Congenital shortening of the fingers or toes

Brodie s Abscess Localized circumscribed osteomyelitic abscess usually of the long bones The virulence of the organism is low Treatment consists in *drainage and curettage and infiltration with powdered sulfanilamide* Prolonged sulfonamide therapy may be required

Calcaneovalgus Sometimes called congenital flatfoot it consists in a deformity where the tibialis anticus is contracted and the gastrocnemius (heel cord group) is weak This is a deformity in which at birth the toes and the top of the foot may lie against the anterior surface of the leg

Cartilaginous Exostoses (Multiple) See Dyschondroplasia

Cavus Hollow foot (contracture of the plantar fascia)

Cervical Rib This is a congenital anomaly and consists of a supernumerary rib attached to one of the cervical vertebrae Because of pressure this rib may produce sensory motor and vasomotor symptoms in the upper extremity

Charcot Joint Degenerative proliferative joint lesion of tertiary syphilis causing instability and enlargement, but lacking in pain

Chondritis Inflammation of a cartilage

Chondrodystrophy (Hypertrophic) See Dyschondroplasia

Cineplasty A type of operation where a skin tunnel is constructed through muscle belly in an arm amputation By a pulley arrangement the tunneled muscle can be made to actuate the artificial hand

Clutton s Joints Bilateral synovitis of the knees and elbows due to congenital syphilis

Congenital Absence of the Clavicle (Cleidocranialdysostosis Sternocleidodysostosis) The absence of the clavicles is associated with a delay in the closure of the frontal sutures of the skull This causes a box head deformity of the skull and a groove down the center of the forehead

Coxa Means hip

Coxa Plana Head of the femur is flattened

Coxa Valga Increase of the angle between the neck and shaft of the femur

Coxa Vara Decrease of the angle between the neck and shaft of the femur

Cretinism Representing a type of dwarfism caused by insufficient function of the thyroid gland They have large tongues thick lips, flattened noses and puffy eyelids and should be treated by the administration of thyroid extract

Cubitus Means elbow

Dupuytren s Contracture Scar formation in the superficial skin tissues of the palm due to trauma and focal infection One, two or more fingers become flexed toward the palm Treatment is by elimination of foci and complete operative removal of the scar

Dyschondroplasia More common in males than females It is an overgrowth of bone or bony prominences (exostoses) near the epiphysis due to congenital misplacement or abnormal distribution of growth cells It is characterized by multiple overgrowth of the bones near the joints If these bony projections interfere with joint function or if they are subject to local irritation they should be removed

Echinococcus Cyst Destructive bone lesions infected by the *Taenia echinococcus* when the parasite lodges within bone tissue

Epiphysitis (Acute) Disease of epiphyseal region near the joints characterized by pain and tenderness near the joint Motion is usually normal Treatment consists in immobilization in plaster for the mild cases and incision and drainage for the more active ones

Equinus (Like the foot of a horse) It consists in the contracture of the tendo achillis to such an extent that the ball of the foot in walking makes contact with the ground but the heel cannot touch

Fibrositis A rheumatoid involvement of the superficial tissues of the bony surfaces and of the intramuscular and periarticular tissues of the bony surfaces Muscular rheumatism periarthritis Pain is usually referred to the joint but motions are not much limited Fibrous nodules may be found in the hands back and hips The patient feels stiff and has many spots of tenderness Treatment consists in the removal of focal infection with physical therapy treatments and probably the use of vaccines

Flat Feet (Rigid) In certain young individuals pain and stiffness of the ankles may develop without apparent cause *Symptoms* The condition is characterized by progressive knock ankle deformity and limitation of motion in the joints of the foot *Cause* It may be due to an inherent congenital weakness or to inflammatory changes resulting from focal infection *Treatment* By manipulation (under anesthesia) with the correction of the deformity and the application of a plaster cast The corrective procedure should be combined with the removal of any detectable focal infection In cases where there is a fixed deformity reconstructive operation to restore the arch may be required

Gaucher s Disease A generalized bone disease associated with pathology of the spleen The bone lesions are similar to Hyperparathyroidism

Genu Means the knee

Genu Valgum Means knock knees

Genu Varum Means bowlegs

Genu Recurvatum A hyperextended position of the knee (Back knee position)

Gigantism A disease of youth due to overactivity of the anterior portion of the pituitary gland Bony growth is usually symmetrical and the individual may attain a height of from seven to nine feet

Glass Arm An athlete s arm weakened by the presence of subdeltoid bursitis or epicondylar bursitis

Glioma Malignant tumor of the brain or nerve cells

Goniometer A special protractor used to measure joint motion

Gout This is caused by overindulgence in beers and wines and meats The disease is usually seen in the acute attacks which may involve various joints but most commonly the first metatarsophalangeal joint The acute attacks are accompanied by extreme pain redness, and swelling and there has usually been some dietary indiscretion When there has been an excessive intake of purine foods the treatment consists usually in immobilization in splints combined with the elimination of purines and the administration of neocinchophen

Gower s Sign 'Climbing up the legs in progressive muscular dystrophy

Hallux Means great toe

Hallux Valgus Bunion position

Heberden s Nodules Enlargements about the finger joints accompanying chronic arthritis The enlargements are partly bony and partly composed of a gelatinous material

Hemophiliac Joints Hemophiliac joints occur frequently when the disease is present The joints assume a fusiform swelling and there are areas of subcutaneous hemorrhage With the administration of cold packs and vitamin K they tend to subside Immobilization and blood transfusions are important factors in preventing further bleeding Joints after repeated attacks, may finally become ankylosed Any surgery is distinctly contraindicated

Involucrum New bone which grows around the sequestrated shaft of an old bone such as in osteomyelitis

Intermittent Hydrarthrosis This usually occurs between the ages of 30 and 40 years It occurs most frequently in the knee or both knees and is transient Swelling is characteristically painless, lasts a few days, and then disappears only to recur in a month or two There is absence of pain or tenderness or of any abnormality in the x ray findings in the joints It is thought that a disturbance of an allergic or endocrine nature is responsible Spontaneous disappearance of the disease may occur in pregnancy, but as a rule synovectomy offers the best prospect of cure

Kümmel s Disease Delayed collapse of an injured vertebra in which a minor fracture or no fracture was demonstrated by x ray immediately following injury The collapse may occur as late as five or six months after injury

Kyphosis An increase in the posterior curve of the thoracic vertebrae (hunch back)

Little s Disease Congenital cerebral palsy or spastic paralysis

Lordosis Anterior flexion of the lower part of the back causing a hollow back deformity

Macrodactylia Congenital enlargement of one or several digits of the hand or foot May be hereditary

Madelung s Deformity A deformity of the wrist in which the distal end of the radius is displaced anteriorly This causes a dorsal prominence of the distal end of the ulna and limitations in dorsiflexion of the wrist

Marquio s Disease A syndrome of mild dwarfism which is hereditary and involves the body asymmetrically as compared to achondroplasia

Melorheostosis (Flowing Bones) An extremely rare condition in which the cortical portion of the bone is overgrown and gives a flowing appearance It is usually confined to a single extremity

Meningococcus Arthritis Joint infection following meningitis The surrounding tissues are more involved than the joints Prognosis good when immobilization and sulfonamide injection are used Ankylosis not infrequent

Mongolianism An accidental nonhereditary body type having characteristic features of the Mongol race combined with idiocy

Myelomas—Multiple A cancerlike type of generalized bone destruction Always fatal

Myositis Inflammation of a muscle

Myositis Ossificans (Progressiva) A rare disease of unknown origin in which the muscles and fascia are converted into bone It is a childhood disease involving first the spinal muscles and gradually spreading to other parts of the body

Osteitis Deformans (Paget s Disease) A disease of unknown origin which affects persons of middle age and manifests itself by gradual thickening and bowing of the shafts of the long bones and thickening of the skull There are cystic areas in the bone which are filled with gelatinous and fibrous material with a great increase in vascularity The trunk may gradually become shortened and the chest barrel shaped Legs and arms may become bowed The x ray shows characteristic bone changes The patient usually complains of aching pains in the spine and extremities Treatment is directed toward the support or correction of deformities

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Schuller Christian Disease Xanthomatosis A childhood disease characterized by the deposit of fat in the bone as a result of disturbed fat metabolism The x ray findings of multiple cystic areas are characteristic.

Scorbutus Scurvy

Sequestrum Usually refers to dead bone which acts as a medius for continuing drainage, as in osteomyelitis

Spasmodic Wryneck Characterized by jerking motions of the head and neck due to chronic nerve irritation Treatment long immobilization in a plaster cast including the head shoulders and chest

Spondylitis Inflammation of a vertebra

Still s Disease Generalized rheumatoid arthritis in children

Subluxation An incomplete dislocation

Synostosis *Where two contiguous bones become united as a variant from normal* Congenital synostosis of the radius and ulna is an example Trauma can be productive of a synostosis

Synovitis Inflammation of the synovial membrane lining a joint capsule

Talipes Refers to the ankle

Tenodesis Securing a tendon to a bone

Tenotomy Cutting of a tendon

Tuberculous Dactylitis A tuberculous infection of the bones of the fingers and toes It develops in early childhood There are areas of destruction in the phalanges and metacarpals usually accompanied by pus formation and bone sequestration Responds to conservative treatment with rest and sunshine

Typhoid Spine Typhoid bacillus infection of the vertebra coincidental with typhoid fever It is characterized by extreme pain in the back and extremities and elevation of temperature X ray shows localized destruction and proliferation of bone in the low dorsal or lumbar region Treatment usually consists in immobilization by plaster casts Recovery usually takes place but there may be a permanent but localized stiffness

Osteitis of Gerry (Chronic Diffuse Sclerosing) This disease usually occurs in the shafts of the long bones in late childhood There is thickening of the bone and the cortex There may be redness and tenderness and a dull ache Treatment consists in excision of the thickened bone cortex or drilling of holes through it

Osteochondromatosis The formation of multiple loose cartilaginous bodies within joints

Osteoclasis Fracturing a bone surgically by means of an osteoclast

Osteogenesis Imperfecta (Fragilitas Osseum Brittle Bones) A congenital or inherited disease in which the calcium content and size of the bones is far below normal Numerous fractures usually result from even the mildest types of trauma They represent a difficult nursing problem on this account Healing of fractures is normal Dwarfism is common The eyes have a peculiar bluish discoloration of the sclera The condition has a tendency to disappear after puberty but is distinctly hereditary in character Prevention of deformities and later the correction of deformities are *the orthopedic problems*

Osteomalacia A deficiency disease of bone in which decalcification takes place and the bones may collapse Characterized by the heart shaped pelvic ring

Osteopetrosis (Marble Bones) Thickening of the bone cortex throughout the bones of the body including the pelvis vertebrae and skull Blindness is frequently associated with the disease

Osteopoikilosis (Spotted Bones) This is a rare condition in which there is a scattered spotting in the ends of the long bones usually discovered accidentally by x ray There are usually no symptoms

Osteoporosis Decalcification of the bone

Osteosclerosis A group of diseases characterized by abnormal increase in the calcium content of the bone as shown in x ray picture There is a thickening of the cortex and narrowing of the medullary canal Cause unknown

Osteotomy Cutting of bone

Plantar Wart An ordinary wart which occurs on the weight bearing surface of the foot and is usually extremely painful on pressure

Pneumococcus Arthritis Usually follows pneumonia in about two weeks with an active and painful joint infection There is pus formation and poor prognosis is held for the joint Treatment Drainage splinting and the *administration of the sulfonamides*

Polydactylism An excessive number of fingers or toes

Podagra Gouty inflammation of the great toe

Raynaud s Disease A vasomotor constrictor disturbance which may affect the upper or lower extremities or both

Renal Rickets Dwarfism A rare disease of childhood in which there is a replacement of the red bone marrow by fat It is seen in combination with a chronic interstitial nephritis

INDEX

INDEX